ECHNOLOGY DEPT.

In two sections

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EDISON ELECTRIC INSTITUTE BULLETIN

January, 1943

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THE ELECTRIC LIGHT AND POWER INDUSTRY

Current Statistical Data Covering 100 Per Cent of Industry

October, 1942

SOURCE AND DISPOSAL OF ENERGY—MONTH OF OCTOBER

	1942	1941	%
GENERATION* (Net)			
By Fuel Burning Plants	11,239,656,000	11,038,900,000	+ 1.8
By Water Power Plants	5,499,371,000	4,202,600,000	+30.9
Total Generation	**16,739,027,000**	**15,241,500,000**	**+ 9.8**
Add—Net Imports Over International Boundaries		76,947,000	.....
Less—Company Use	(Details Not	238,553,000	.....
Less—Energy Used by Producer	Yet	313,949,000	.....
Net Energy for Distribution	Available)	**14,765,945,000**	.....
Losses and Unaccounted For		2,385,861,000	.....
Sales to Ultimate Customers	**13,969,794,000**	**12,380,084,000**	**+12.8**

CLASSIFICATION OF SALES

NUMBER OF CUSTOMERS—As of October 31st			
Residential or Domestic	26,617,516	25,879,404	+ 2.9
Rural (Distinct Rural Rates)	1,098,961	981,057	.....
Commercial or Industrial:			
Small Light and Power	4,256,625	4,288,660	− 1.2
Large Light and Power	152,126	174,849	
Other Customers	124,650	120,826	.....
Total Ultimate Customers	**32,249,878**	**31,444,796**	**+ 2.6**
KILOWATTHOUR SALES—During Month of October			
Residential or Domestic	2,223,626,000	2,091,593,000	+ 6.3
Rural (Distinct Rural Rates)	269,389,000	226,238,000	+19.1
Commercial or Industrial:			
Small Light and Power	2,271,613,000	2,099,961,000	+ 3.3**
Large Light and Power	7,956,603,000	6,951,103,000	+16.1**
Street and Highway Lighting	185,380,000	193,302,000	− 4.1
Other Public Authorities	384,843,000	274,906,000	+40.0
Railway and Railroads:			
Street and Interurban Railways	354,591,000	322,321,000	+10.0
Electrified Steam Railroads	205,824,000	178,456,000	+15.3
Interdepartmental	117,835,000	42,204,000	+179.2
Total to Ultimate Customers	**13,969,794,000**	**12,380,084,000**	**+12.8**
Revenue from Ultimate Customers	**$243,094,100**	**$228,883,900**	**+ 6.2**

(a) Subject to Revision following state by state analysis now under way.
(**) Based on changes made in same classifications both years.

RESIDENTIAL OR DOMESTIC SERVICE (Revised Series)

AVERAGE CUSTOMER DATA—For the 12 Months Ended October 31st			
Kilowatthours per Customer	1,018	980	+ 3.9
Average Annual Bill	$37.46	$36.75	+ 1.9
Revenue per Kilowatthour	3.68¢	3.75¢	− 1.9

(*) By Courtesy of the Federal Power Commission.

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EDISON ELECTRIC INSTITUTE BULLETIN

Volume 11 JANUARY, 1943 No. 1

The Electric Light and Power Industry in 1942

Electric Power Supply Proves Equal to War Demands

THE stability and resourcefulness of the electric light and power industry is again being demonstrated by the present war emergency. All demands for electricity for the munitions and armament of the armed forces have been successfully met in every section of the nation; the requirements for civilian use have been covered without resort to curtailment or rationing and the margin of reserves for the country as a whole has been increased substantially over last year's levels.

Along with the progressive construction of new munitions plants the conversion of existing facilities has freed for the production of war materials much of the load which was formerly devoted to peacetime and civilian uses. Largely as a result of these characteristics of the war effort, utility sales of industrial power increased only 16 per cent in 1942 notwithstanding the enormous increase in war expenditures of 377 per cent during the same period and the corresponding increase in the production of munitions. Industrial power sales rose from 76,000,000,000 kwhr in 1941 to 88,000,000,000 in 1942. In spite of this rise in industrial power sales, this class represented but 56 per cent of the utilities' total sales as compared with 54 per cent a year ago.

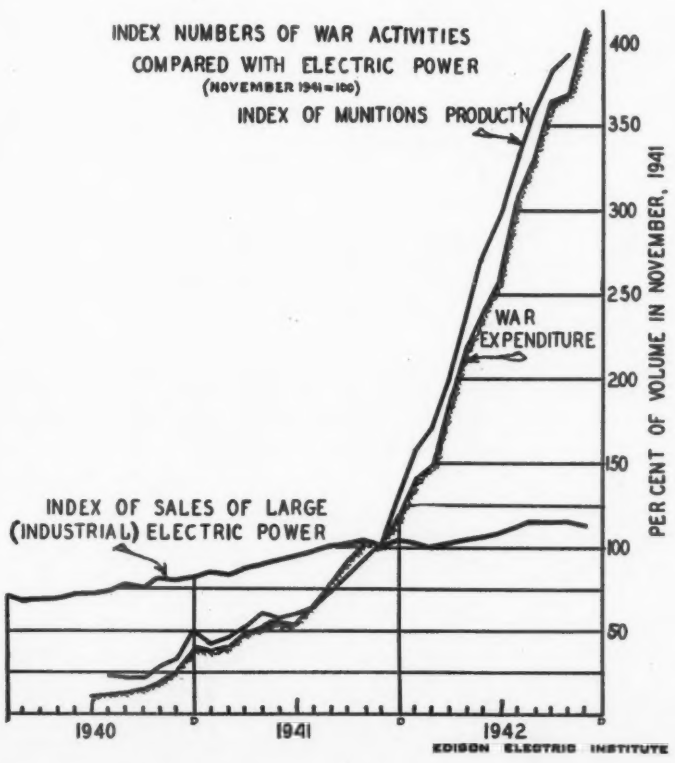
At the same time, and in the face of dim-outs, daylight saving and other factors, the other uses of electricity have shown an only slightly less vigorous growth from 64 billion kilowatthours in 1941 to an estimated total of 71 billions in 1942; an increase of 7 billion kilowatthours, or 11 per cent.

As far as the year 1942 is concerned, the long time trends prevailing in the electric light and power industry persisted with but little change. In spite of the shutting down of many small business and commercial establishments, a net gain of over 600,000 customers was recorded during the year; the relatively small slowing down of sales of electricity for business use was largely offset by the demands of government for housing and similar purposes, and the use of electricity by the residential household consumer continued to reach new high levels.

With the controllable operating expenses heavily pared by the elimination of peace-time functions no longer necessary in a war economy, much of the additional expense of carrying on a larger volume of business has been offset, and earnings before taxes have, in the main, been satisfactory. Federal taxes, however, have more than siphoned off all the gains in operating net earnings as fast as they have appeared.

Generating Capacity at End of Year

Approximately 2,920,000 kw of new generating capacity were added to the public utility power houses during 1942 and some 200,000 kw were retired, leaving a net increase of 2,720,000 kw for the year and bringing the grand total of generating capacity to approximately 47,000,000 kw. This compares with a net increase of 2,450,000 in 1941 and, except for the boom year of 1925, repre-



GENERATING CAPACITY BY STATES AND TYPE OF PRIME MOVER

(Kilowatt Generator Capacity of All Plants Contributing to the Public Supply)
Estimated for December 31, 1942

	Total	Steam	Hydro	Internal Combustion
Total United States	46,811,500	32,478,700	13,273,900	1,058,900
Maine	313,800	90,800	220,200	2,800
New Hampshire	315,700	80,500	233,500	1,700
Vermont	177,100	9,900	166,500	700
Massachusetts	1,420,500	1,244,200	167,300	9,000
Rhode Island	282,100	278,500	3,300	300
Connecticut	831,300	735,500	90,700	5,100
Total New England	3,340,500	2,439,400	881,500	19,600
New York	5,890,300	4,692,800	1,171,300	26,200
New Jersey	1,446,500	1,435,400	7,100	4,000
Pennsylvania	3,416,200	2,980,800	424,700	10,700
Total Middle Atlantic	10,753,000	9,109,000	1,603,100	40,900
Ohio	3,013,000	2,983,400	12,200	17,400
Indiana	1,387,600	1,325,600	35,500	26,500
Illinois	2,841,100	2,771,100	48,400	21,600
Michigan	2,236,400	1,838,900	350,900	46,600
Wisconsin	1,136,400	836,300	279,100	21,000
Total East North Central	10,614,500	9,755,300	726,100	133,100
Minnesota	762,600	557,300	157,400	47,900
Iowa	743,000	519,800	131,100	92,100
Missouri	861,300	647,500	158,400	55,400
North Dakota	96,700	85,400	0	11,300
South Dakota	90,200	55,200	3,300	31,700
Nebraska	420,300	223,800	142,600	53,900
Kansas	537,900	448,300	6,900	72,700
Total West North Central	3,502,000	2,537,300	599,700	365,000
Delaware	38,000	33,200	0	4,800
Maryland	756,000	474,100	271,400	10,500
District of Columbia	358,000	355,000	3,000	0
Virginia	670,000	474,800	181,500	13,700
West Virginia	863,000	757,100	101,000	4,900
North Carolina	1,468,300	685,100	772,800	10,400
South Carolina	792,900	137,400	650,800	4,700
Georgia	627,300	281,400	343,500	2,400
Florida	468,100	414,100	14,400	39,600
Total South Atlantic	6,041,600	3,612,200	2,338,400	91,000
Kentucky	460,300	346,000	111,100	3,200
Tennessee	1,050,900	912,100	736,900	1,900
Alabama	1,196,500	282,600	909,100	4,800
Mississippi	64,500	48,900	0	15,600
Total East South Central	2,772,200	989,600	1,757,100	25,500
Arkansas	157,200	73,600	67,100	16,500
Louisiana	427,200	381,900	0	45,300
Oklahoma	453,500	339,600	59,300	54,600
Texas	1,297,100	1,043,700	152,400	102,000
Total West South Central	2,335,000	1,837,800	278,800	218,400
Montana	336,500	12,300	321,300	2,900
Idaho	270,000	700	266,100	3,200
Wyoming	86,400	32,100	49,700	4,600
Colorado	328,000	245,100	66,200	16,700
New Mexico	145,000	99,900	25,200	19,900
Arizona	703,600	116,500	540,800	46,300
Utah	168,500	66,300	91,900	10,300
Nevada	509,600	2,500	504,000	3,100
Total Mountain	2,547,600	575,400	1,865,200	107,000
Washington	1,357,300	217,500	1,137,700	2,100
Oregon	692,200	190,300	496,500	5,400
California	2,855,600	1,214,900	1,589,800	50,900
Total Pacific	4,905,100	1,622,700	3,224,000	58,400

CAPACITY AND GENERATION DATA (KILOWATTS)

(1941 final and 1942 preliminary)

BY TYPE OF PRIME MOVER

Kilowatthours Generated

1942	Total	Steam	Hydro	Internal Combustion
New England	10,720,000,000	7,745,000,000	2,940,000,000	35,000,000
Middle Atlantic	45,050,000,000	35,590,000,000	9,390,000,000	70,000,000
East North Central	43,200,000,000	39,430,000,000	3,520,000,000	250,000,000
West North Central	10,600,000,000	7,000,000,000	2,940,000,000	660,000,000
South Atlantic	23,930,000,000	16,580,000,000	7,200,000,000	150,000,000
East South Central	12,700,000,000	4,355,000,000	8,300,000,000	45,000,000
West South Central	9,970,000,000	8,650,000,000	920,000,000	400,000,000
Mountain	10,730,000,000	1,670,000,000	8,900,000,000	160,000,000
Pacific	21,600,000,000	2,480,000,000	19,090,000,000	30,000,000
Total United States	186,500,000,000	123,500,000,000	63,200,000,000	1,800,000,000
Final 1941 figures	168,169,980,000	115,276,508,000	51,261,768,000	1,631,704,000
Increase (Kwhrs)	20,330,020,000	8,223,492,000	11,938,232,000	168,296,000
" (%)	+12.1	+7.1	+23.3	+10.3

Capacity in Kilowatts

1942	46,811,500	32,478,700	13,273,900	1,058,900
1941	44,092,201	30,823,455	12,263,587	1,005,159
Net Increase	2,719,299	1,655,245	1,010,313	53,741
%	+6.2	+5.4	+8.2	+5.3

Kilowatthours Generated per Kw of Capacity

1942	4,147	3,902	4,949	1,744
1941	3,923	3,855	4,277	1,666

BY OWNERSHIP GROUPS

Kilowatthours Generated (000's)

	Total	Electric Companies	Municipal Plants	Governmental Plants	Others
1942	188,500,000	158,300,000	7,700,000	18,500,000	4,000,000
1941	168,169,980	144,289,667	7,022,541	12,985,876	3,871,896
Increase (Kwhrs)	20,330,020	14,010,333	677,459	5,514,124	128,104
" (%)	+12.1	+9.7	+9.6	+42.5	+3.3

Capacity in Kilowatts

1942	46,811,500	37,639,500	3,234,000	4,082,000	1,856,000
1941	44,092,201	36,041,274	3,158,485	3,037,246	1,855,196
Increase (net)	2,719,299	1,598,226	75,515	1,044,754	804
" (%)	+6.2	+4.4	+2.4	+34.4	-

sents the largest annual increase in generating plant in the history of the industry. After deducting equipment retired from service or reduced in capacity rating, the net gain in steam generating equipment was 1,655,000 kw, in hydro electric plants 1,011,000 and internal combustion engines 54,000 kw.

Electric utility companies added 1,600,000 kw of net capacity, Federal Government and district projects added 1,045,000 and municipal systems added 75,000 kw.

Additional 3,384,000 Kilowatts Scheduled for 1943

In line with the recently announced policy of the federal government to restrict all types of construction to enterprises capable of early completion, about 2,800,000 kw of prospective power installations were ordered cancelled by the WPB in 1942. The bulk of this cut affects generating equipment scheduled for 1944 and 1945.

The total net increase in generating capacity scheduled for 1943 is 3,384,000 kw, with 521,000 for 1944 and 195,000 for 1945, making a total during the next three years of 4,000,000 kw.

Margin of Reserves Increased in 1942

The sum of the noncoincident peak loads at the generating stations for December, 1942, for all stations contributing to the public supply, is estimated to have been 37,000,000 kw. This is about 5 per cent above the figure for last year and is 10,000,000 kw below the total installed capacity of these generating stations. The same margin last December was 9,000,000 kw, so that the margin of reserve capacity was increased during the year by 1,000,000 kw.

For the group of larger (or so-called Class I utilities) reporting to the Institute, the sum of the noncoincident peak loads for December is estimated to have been 33,000,000 kw as compared with approximately 31,500,000 kw in 1941. This figure of 33,000,000 kw for these larger systems is 8 per cent below the estimates made by them a year ago, and is nearly 20 per cent below the forecast of the Federal Power Commission of a year and a half ago. Daylight saving time introduced in February of this year affected these earlier estimates by about a million kilowatts, or 3 per cent of the total. Other factors in the over-estimates made a year ago were insufficient allowance for decrease in the non-defense industrial load and the failure of war loads to materialize as rapidly and as much as had been anticipated.

Construction Expenditures Next Year

In 1942, the electric utility companies of the United States spent, in round numbers, $482,000,000 on new construction. This compares with a total of $592,000,000 in 1941 and $622,000,000 as the budget for 1942 proposed last year. Because of limitations on the supply and use of materials the actual expenditures were only 78 per cent of the amount budgeted. The curtailment, however, was largely in distribution and general plant where only 65 per cent of the budget was expended and compares with 86 per cent for generating and transmission facilities.

The principal items are approximately as follows:

	1942 Budget	*1942 Expenditures*	*1943 Budget*
Generation	$261,195,000	$224,000,000	$129,000,000
Transmission	108,022,000	94,000,000	30,000,000
Distribution	226,551,000	148,000,000	90,000,000
General	26,177,000	16,000,000	7,000,000
Total	$621,945,000	$482,000,000	$256,000,000

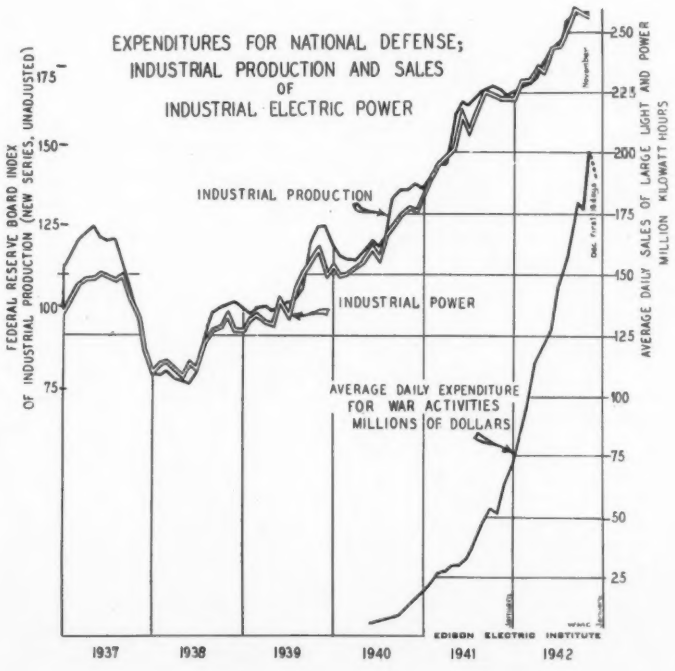
1943 Outlook—Ample Capacity in Every Sector

In view of existing margins of reserves in generating capacity and scheduled additions to this capacity in 1943, it now appears that in every sector of the country there will be ample generating capacity to serve the peak demands reasonably to be expected. This takes into account existing trends in power demands and all the new demands for power that are in sight for this year or can be anticipated at this time. No power shortage is on the horizon for 1943, when America's war effort is expected to be at its peak.

Output 188,500,000,000 kwhr Up 12 Per Cent

Output of electricty in 1942 by all agencies contributing to the public supply totaled approximately 188,500,000,000 kwhr, an increase of 20,330,000,000 kwhr, or 12 per cent over the production in 1941. This increase is somewhat less than the 23,185,000,000 kwhr, or 16 per cent, registered in 1941 over the previous year.

In 1942, fuels produced 125,300,000,000 kwhr, an increase of 7 per cent and water power produced 63,200,000,000, an increase of 23 per cent over output in 1941. This remarkable gain in hydroelectric production reflects the breaking of the drouth which prevailed east of the Mississippi for the greater part of last year as well as the further installation of 1,000,000 kw of hydroelectric generators during 1942.



KILOWATTHOUR GENERATION AND SALES, 1941 AND 1942

(1942 Estimate)

Source and Disposal of Energy

	1942	1941 (Trend)	%
GENERATION (Net)			
By Steam Plants	123,500,000,000	115,276,508,000	+ 7.1
By Water Power Plants	63,200,000,000	51,261,768,000	+23.3
By Internal Combustion Plants	1,800,000,000	1,631,704,000	+10.3
Total Generation	188,500,000,000	168,169,980,000	+12.1
Add - Net Imports Over Internat'l Bound...	1,500,000,000	927,320,000	+61.8
Less-Company Use	(6,000,000,000	2,465,901,000)	- 5.3
Less-Energy Used by Producer	(	3,868,639,000)	
NET ENERGY FOR DISTRIBUTION	184,000,000,000	162,762,560,000	+13.0
Losses & Unaccounted For	25,200,000,000	22,702,401,000	+11.0
Sales to Ultimate Customers	158,800,000,000	140,060,159,000	+13.4

Classification of Sales

Number of Customers - (12-31-42)			
Residential or Domestic	26,616,400	26,025,513	+ 2.3
Rural (Distinct Rural Rates)	1,102,892	986,719	+11.8
Commercial & Industrial			
Small Light & Power	4,223,770	4,299,976	- 2.3*
Large Light & Power	148,887	172,677	- 0.6*
Street & Highway Lighting	25,142	24,932	+ 0.8
Other Public Authorities	97,383	95,948	+ 1.5
Railways and Railroads			
Street & Interurban Railways	183	194	
Electrified Steam Railroads	31	31	
Interdepartmental	1,200	1,381	
Total Ultimate Customers	32,215,888	31,607,371	+ 1.9
Kilowatthour Sales			
Residential or Domestic	27,000,000,000	25,123,900,000	+ 7.5
Rural (Distinct Rural Rates)	2,900,000,000	2,351,653,000	+23.3
Commercial & Industrial			
Small Light & Power	27,350,000,000	24,627,985,000	+ 6.4*
Large Light & Power	88,000,000,000	76,060,536,000	+17.4*
Street & Highway Lighting	2,000,000,000	2,110,444,000	- 5.5
Other Public Authorities	4,000,000,000	3,093,337,000	+29.3
Railways and Railroads			
Street & Interurban Railways	4,200,000,000	3,959,817,000	+ 6.1
Electrified Steam Railroads	2,300,000,000	2,118,238,000	+13.5
Interdepartmental	950,000,000	614,249,000	+54.7
Total Ultimate Customers	158,800,000,000	140,060,159,000	+13.4
Revenue			
Residential or Domestic	$ 991,800,000	$ 938,228,600	+ 5.7
Rural (Distinct Rural Rates)	75,500,000	64,395,600	+17.3
Commercial & Industrial			
Small Light & Power	771,800,000	725,117,400	+ 1.6*
Large Light & Power	823,100,000	758,082,700	+13.8*
Street & Highway Lighting	75,300,000	76,949,200	- 2.2
Other Public Authorities	57,100,000	49,202,800	+15.9
Railways and Railroads			
Street & Interurban Railways	34,800,000	32,471,500	+ 7.2
Electrified Steam Railroads	18,500,000	16,473,700	+12.1
Interdepartmental	5,100,000	4,135,500	+24.3
Total Ultimate Customers	$2,853,000,000	$ 2,665,057,000	+ 7.0

*Based on changes made in some classifications both years.

NUMBER OF CUSTOMERS AT END OF 1942

(By Class of Service---Dec. 31, 1942, estimate)

(The Electric Lt & Pwr Industry) (100 % of the Industry)

	Total	Residential or Domestic	Rural (Distinct Rural Rates)	Commercial and Industrial Small	Commercial and Industrial Large	St & Highway Ltg	Other Public Authorities	Rwys & RR's	Interdepartmental
Total U S	32,215,888	26,616,400	1,102,892	4,223,770	148,887	25,142	97,383	214	1,200
Maine	235,173	189,000	9,800	30,000	3,650	470	2,250	1	[illegible]
New Hamp.	152,147	131,000	190	18,000	1,020	223	1,710	2	[illegible]
Vermont	94,224	76,300	3,280	11,700	2,050	222	670	1	1
Mass.	1,328,285	1,145,000	1,040	175,600	5,500	650	278	7	210
Rhode Isl.	214,657	188,000	420	25,250	860	41	86	-	[illegible]
Conn.	547,517	477,000	2,730	63,000	4,600	79	106	-	[illegible]
New Eng.	2,572,003	2,205,300	17,460	323,550	17,660	1,685	5,100	11	217
New York	4,132,098	3,510,000	110	600,000	7,000	1,590	13,300	17	81
New Jersey	1,330,225	1,135,000	76	190,000	2,700	690	1,250	5	4
Penn.	2,580,227	2,210,000	31,500	313,000	17,000	1,840	6,840	22	25
Mid. Atl.	8,042,550	6,855,000	31,686	1,103,500	26,700	4,120	21,390	44	110
Ohio	1,999,102	1,687,000	80,500	210,000	11,725	1,000	8,840	16	21
Indiana	952,645	765,000	66,400	107,500	8,100	1,000	4,600	9	36
Illinois	2,183,422	1,850,000	69,000	250,000	10,300	1,070	3,030	12	10
Michigan	1,533,491	1,345,000	15,200	168,500	2,500	900	1,360	6	25
Wisconsin	833,694	650,000	7,000	106,000	1,520	1,595	545	4	30
E. No Cent	7,502,354	6,297,000	305,100	842,000	34,145	5,565	16,375	47	122
Minnesota	661,609	542,000	16,300	100,800	1,040	720	745	4	[illegible]
Iowa	620,460	480,000	40,400	96,000	1,950	825	1,280	4	[illegible]
Missouri	854,124	695,000	30,600	124,000	2,240	560	1,700	2	22
No Dakota	95,741	71,600	1,515	21,400	630	374	218	-	4
So Dakota	99,634	76,200	1,130	21,650	158	318	368	1	10
Nebraska	288,493	234,000	11,000	41,500	170	440	1,360	3	20
Kansas	423,496	330,000	23,050	57,500	1,330	640	1,920	-	56
W. No Cent	3,043,757	2,437,800	123,995	452,850	7,518	3,877	7,591	14	112
Delaware	71,997	61,300	990	9,050	416	63	175	1	2
Md & D. C.	653,534	539,000	27,900	84,700	1,310	222	390	7	5
Virginia	489,075	410,000	11,500	63,500	1,415	268	2,360	2	10
West Virg.	336,750	274,000	21,200	38,000	1,560	242	1,702	4	42
No. Carolina	514,660	410,000	27,500	72,000	3,500	430	1,100	2	128
So. Carolina	240,710	194,000	9,100	36,000	1,200	280	130	-	[illegible]
Georgia	449,808	383,000	2,400	63,000	700	527	177	1	3
Florida	417,585	345,000	550	67,000	1,300	265	3,400	-	70
So.Atlantic	3,174,119	2,616,300	101,140	433,250	11,401	2,137	9,434	17	260
Kentucky	420,192	346,000	16,600	49,500	4,650	300	3,060	1	1
Tennessee	452,385	385,000	9,300	53,500	1,200	300	3,060	14	11
Alabama	340,770	262,000	30,000	38,300	1,400	317	750	-	3
Mississippi	192,565	150,000	10,800	29,300	600	265	1,600	-	[illegible]
E. So Cent	1,405,912	1,143,000	74,700	170,600	7,850	1,262	8,470	15	15
Arkansas	211,348	149,000	24,700	34,200	1,290	272	1,880	1	5
Louisiana	348,084	295,000	2,550	46,500	2,500	270	1,260	1	3
Oklahoma	377,516	300,000	15,000	53,000	7,300	352	1,050	4	10
Texas	1,164,648	920,000	68,000	153,000	8,400	1,200	5,000	4	32
W. So Cent	2,101,596	1,664,000	110,250	295,700	19,490	2,094	9,190	10	82
Montana	118,817	100,000	3	18,000	450	190	80	2	92
Idaho	135,978	110,000	4,900	19,000	440	170	1,460	-	8
Wyoming	52,356	43,500	410	7,200	1,090	67	69	-	11
Colorado	277,422	216,500	15,700	37,000	7,300	205	706	-	[illegible]
New Mexico	72,348	59,500	8	12,500	100	52	188	-	[illegible]
Arizona	112,777	95,000	1,570	15,700	310	61	124	-	[illegible]
Utah	155,356	137,500	670	14,750	1,100	246	1,080	10	[illegible]
Nevada	31,830	26,500	-	5,170	113	41	6	-	[illegible]
Mountain	956,864	788,500	23,261	129,320	10,903	1,032	3,733	13	122
Washington	585,988	490,000	24,000	65,000	4,800	720	1,430	18	20
Oregon	339,923	283,500	9,300	43,000	2,200	250	1,670	3	[illegible]
California	2,490,802	1,835,000	282,000	355,000	6,200	2,220	10,200	22	160
Pacific	3,416,713	2,608,500	315,300	463,000	13,200	3,190	13,300	43	180

Coal Shortage 50 Per Cent Above Normal

Heeding last summer's counsel of the Bituminous Coal Division, utilities have enlarged their coal storage to the highest amount on record. They now are carrying almost four months' supply, an amount ample to last through the winter. Normally their coal storage is 80 days' supply. This storage measure has helped to even out the seasonal demands for coal and to make more flexible the demands on railroad service.

America Now Producing Two-Fifths of World's Power Supply

In addition to the production by public utilities, a considerable number of manufacturing plants and mines produce their own electric power. These plants are estimated to have generated some 46,500,000,000 kwhr during the year.

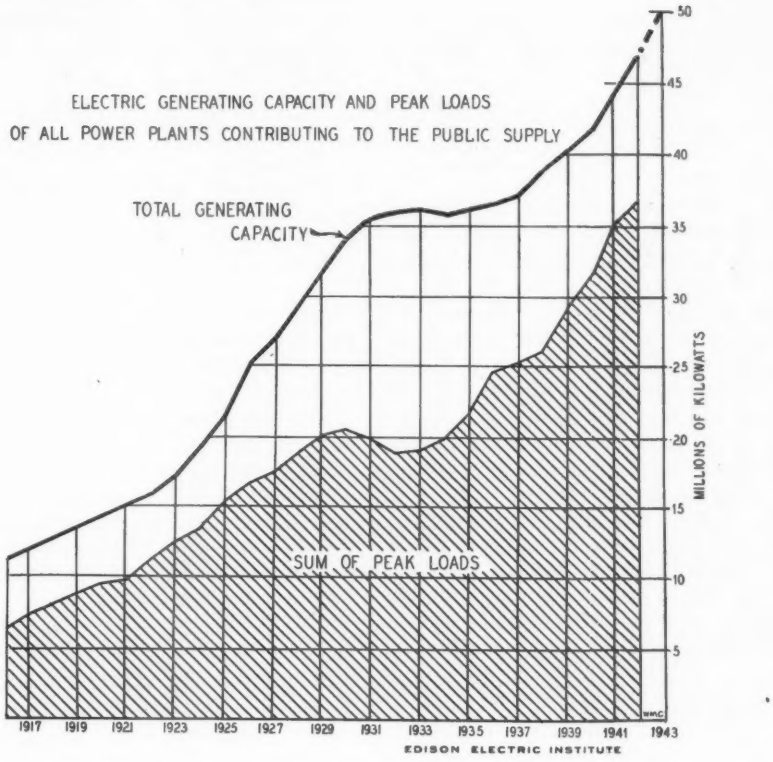
If to the production of public utilities is added this production of their own power by manufacturing plants and mines, the grand total output of electric power from all sources in the United States is 235,000,000,000 kwhr. In 1938, Germany produced 55 billion, Italy 15, Japan 27, Russia 33, Great Britain 31, France 20, and Canada 26. All the world combined produced 465,000,000,000 kwhr. Estimating from previous rates of growth and various indications of subsequent construction programs, the probable world production of power in 1942 was about 600,000,000,000 kwhr and the probable production in Axis dominated areas about 200,000,000 kwhr.

Sales of Electricity

Except for street and highway lighting, which has been drastically curtailed by the requirements of the war, all classes of service showed practically the usual rates of growth during the year.

The use of electricity in the home increased by nearly 2,000,000,000 kwhr, or by 7½ per cent. In spite of the practical cessation of sales of household electric appliances early in the year, the annual electrical use of the average residential customer crossed the 1000 kwhr mark last March and now stands at 1024 kwhr per year. This represents an increase of 38 kwhr, or 4 per cent, over the figures for 1941. At the same time, and in the face of rising costs of living and doing business, the average price of electricity for this service was reduced to 3.67 cents per kwhr from a figure of 3.73 cents the year before.

Compared with September, 1939, when hostilities in Europe began, the individual items of the cost of living, as shown by the U. S. Department of Labor, have shown the following changes:



Food	+35%
Clothing	+25%
Housefurnishings	+21%
Rent	+ 3%
Fuel and Ice	+18%
Entire Cost of Living	+19%
Electricity	— 2%

The price of electricity has continued its steady decrease, the composite average for all domestic use having declined from 4.04 cents per kwhr for the 12 months ending with September, 1939, to 3.68 cents for September, 1942.

Financial

Except for taxation, the 1942 financial results were, in general, satisfactory. Total revenues of the private companies in 1942 approximated $2,630,000,000, an increase of $155,000,000 or 6½ per cent over the year before. According to the financial reports published for the first 10 months of the year (with November and December estimated) operating expenses and depreciation rose at about the same rate as revenues, while State and local taxes showed only a slight change. As a result, net income after all charges, but before Federal taxes, is expected to show a gain of some $55,000,000 or 6½ per cent, over a year ago. Federal taxes, however, have increased from $300,000,000 last year to an estimated total of $410,000,000 in 1942. This rise of $110,000,000 in taxes wipes out all of this gain in net income and leaves the balance for stockholder's return and surplus some $55,000,000 less than it was last year.

The total of all taxes—Federal, State and local—is estimated at $635,000,000 for the year 1942. This represents an increase of $114,000,000 or 22 per cent, coming on top of an increase of 29 per cent last year. During the four years 1938 to 1942, taxes on electric utilities have doubled, whereas revenues have increased by only a third. Taxes now consume 24 per cent of every dollar collected from the user of electricity.

The composite income statement of the operating electric utility companies will show a net income, after all charges and taxes, of about $485,000,000 for 1942. This represents a decrease of some 10 per cent from the $539,000,000 earned in 1941. After the payment of $130,000,000 in preferred dividends about $355,000,000 will be left for the return on common stocks and for surplus. This is $55,000,000 less than in 1941. The continuing decline in net income during the past two years is directly due to the Federal excess profits tax.

*Based on changes made in some classifications both years.

Effect of War Taxes Upon Utility Regulation

By R. W. Peterson
Chairman, Public Service Commission of Wisconsin

An address at the 1942 War Convention of the National Association of Railroad and Utilities Commissioners, St. Louis, Mo., Nov. 10-12, 1942

WAR always has been, and always will be, the world's largest consumer. In the consumption of men and money, the present war is without precedent. Its demands, both in men and money, must be met. In the United States, so far as men are concerned, the Conscription Act is supplying the men. So far as money is concerned, the Revenue Act of 1942 will go part way toward supplying it.

Utilities will feel the burden of this unprecedented tax bill. This is not unusual; so will everyone else. Because of the fact that public utilities are regulated, the high war tax brings up several interesting problems, peculiar to that industry, which problems will be discussed herein.

The present revenue act provides for a normal income tax on corporations of 24 per cent; a surtax of 16 per cent; and an excess profits tax of 90 per cent, with provision for a special credit or refund equal to 10 per cent of the excess profits tax. This credit is payable in non-interest-bearing government bonds maturing after the war, or may be used up by the taxpayer, in whole or in part, through a credit against the excess profits tax of 40 per cent of the reduction in the taxpayer's debt, not, however, to exceed the 10 per cent credit. Thus, the effective excess profits tax rate becomes 81 per cent.

The excess profits tax may be computed on either an invested capital basis or the average income basis. If the invested capital basis is used, an income credit of 8 per cent on the first $5,000,000 of invested capital; 7 per cent on the second $5,000,000; 6 per cent on the next $190,000,000, and 5 per cent on all over $200,000,000 is allowed. Under the average income method, the excess profits income credit is 95 per cent of the base period net income, plus 8 per cent of the net capital addition during the year, or less 6 per cent of the net capital reduction during the year. The base period net income is the period commencing with the beginning of the first taxable year after Dec. 31, 1935, and ending with the close of the last taxable year beginning before Jan. 1, 1940. On a calendar year basis, the period covers the four years, 1936 to 1939, inclusive.

Whether a utility uses the invested capital or the average income basis of computing excess profits income credit will depend upon the particular circumstances affecting its tax status. The amount of its statutory invested capital and the level of its income during the base income period are important considerations. Under the revenue act, the lower of the taxes determined by either of the two methods is the correct tax. Hence, the general practice will be to compute the excess profits income credit on the invested capital basis and use the credit under the average income basis as a "floor" indicating the point at which the tax liability should be computed on the average income basis.

It might be thought that an excess profits tax would have little effect on utilities because their rates are regulated, and it can be advanced that if the regulatory agency is doing a proper job, there would be no excess profits. But the tax, although called an excess profits tax is a misnomer, for although it will reach true excess profits, it likewise taxes income which is not ordinarily considered to be excessive. This is due in part to the fact that the excess profits tax is computed before normal and surtaxes. Thus it taxes an income from which all costs have not been deducted and hence will create liability for excess profits taxes even in instances where there are no true excess profits.

Relief from a part of the tax burden is given utilities, in a provision of the bill, providing that dividends paid on preferred stock are deductible in computing surtax net income. This provision of the act applies *only to utilities*, and is further restricted to only those utilities whose rates for service are established or approved by a regulatory authority. Thus, the act recognizes that in the case of a regulated industry some concession in tax liability is proper.

The utility tax burden will decrease returns substantially. The exact extent of the decline is difficult to measure due to the variety of circumstances which may affect such tax liability. However, from test calculations which have been made, it appears that utilities frequently have returns, before federal income and excess profits taxes, of around 8 per cent on their security structure. After the taxes imposed by the new revenue act, this return will be reduced to around 4½ per cent in many instances. Under today's taxes, high or even normal returns are out of the question, except perhaps in unusual situations where a utility may be entitled to certain unusual allowable deductions or credits, or may receive tax benefits through consolidated returns.

The likelihood of passing the war taxes on to customers in the form of rate increases appears remote during the war. The federal government is active in its efforts to stabilize prices, and utility regulatory authorities have been alive to the problem, and have not permitted the passing on of these tax increases. The Wisconsin Commission was one of the first to adopt such a policy. On May 5, 1942, in a case involving an application by the Bell Company for an increase in rates at its Madison exchange, the Commission said in denying the application:

"We do not look with favor upon proposals to increase utility rates in these times. There may be instances where some increases are necessary in order to insure the financial ability of the utility to continue in the rendition of service. But rates should not be increased solely because the management may consider that its return is less than it is entitled to ask in normal times.

"We believe that as far as possible within the range of reasonable requirements, present rates should be stabilized for the duration; and so long as there is a ceiling on prices of other human necessities, the rates for utility service should be 'frozen' and certainly should not be regulated upon precisely the same considerations as prevail in normal times."

In its recent decision in the Panhandle Eastern Pipe Line Company case, under date of Sept. 23, 1942, four and one-half months after the Wisconsin decision, the Federal Power Commission said:

"So that there may be no confusion

concerning the tax situation in connection with the companies subject to our jurisdiction, where necessary to stabilize utility rates at reasonable levels during the war emergency period, we propose to allow as proper operating expenses only such taxes as may be termed ordinary or normal. For the purpose of distinguishing between ordinary or normal and war emergency or abnormal taxes, we conclude that the basis prescribed in the 1940 Revenue Act establishes the highest level of federal taxes which may be allowed as an element of operating expense for such purpose. The 1941 Revenue Act and the pending 1942 proposal certainly reflect abnormal tax requirements for war purposes."

It seems clear that during the war the increases in taxes will not be passed on to customers through higher rates. But what about the period immediately following the war? The taxes will be with us for some time. It is estimated by the House Ways and Means Committee that the gross national debt will be $129,000,000,000 by June 30, 1943, and it will undoubtedly increase after that date. The cost of paying principal and interest on this debt, in addition to normal federal expenditures, means that the high tax burden must continue. Hence, the war taxes cannot be viewed merely as a temporary and non-recurring cost which will soon be past. Instead, it appears that taxes have reached a new plateau, at which level they may remain for a number of years. For the future, "normal" taxes must be high taxes.

In accordance with long-established regulatory practice and legal precedent, normal taxes, even though at high levels, would ordinarily be passed on to customers through rates for service. But practical aspects of the problem make this solution unlikely. Even if regulatory authority is willing to grant rate increases, the business may not stand the additional burden on sales. Under the present statute, for example, if a utility is subject to the 81 per cent excess profits tax, a $1 increase in rates would produce about $0.17 increase in net income after consideraing that other taxes would also take a piece of the dollar. Increasing rates to cover such taxes, and to yield what has been considered normal returns, might well force rates so high as to deter the development of utility business, or even to cause a decline in the use of utility service with consequent diminishing returns.

It seems obvious then that returns of utilities must suffer. They have already been reduced and will probably remain at a level lower than previously considered normal so long as the war taxes are in force.

The low returns, which will be earned, may have an effect on what is held to be a reasonable return, in rate cases. During the recent past, returns approximating 6 per cent have generally been held to be reasonable and applied in many instances. Under the impact of war taxes, there will be instances where such returns cannot be earned, even though the regulatory agency were to authorize rate increases. War taxes will automatically put a ceiling on returns of around 4½ per cent. If this is all that a utility can earn, after all costs including taxes, it may follow that such returns will be held to be reasonable, or at least non-confiscatory, under the circumstances prevailing.

It may be that a utility will get the benefits of a large invested capital, because of the high prices it has paid for property in earlier years, and will not be liable for excess profits taxes. Or, it may escape the taxes through the medium of consolidated returns. For these, and perhaps other reasons, the returns of some utilities will not be reduced by the excess profits tax, and may remain at a higher level than those utilities which incur such tax liability.

This brings up the interesting question as to whether the same standard for return should be applied to all utilities. If a soundly financed utility, paying its full share of the cost of war including excess profits taxes, is restricted by such taxes to a return of 4½ to 5 per cent, should the same standard of return be applied to other utilities which, because of fortuitous circumstances affecting their tax situation, pay less taxes and show higher returns?

Of course, one single rate of return is not necessarily reasonable or fair in all instances. A range or zone of reasonableness exists, any rate within which might be reasonable. But the low returns, which it is possible to earn by many soundly financed and well-managed utilities, may well influence views of what constitutes reasonable allowable returns over and above all costs in other instances. Hence, there is probability that allowable returns for utilities, not so seriously affected by taxes, may tend toward the level of those of utilities paying higher taxes. How this may be brought about, I do not hazard a guess. I merely cite it as a future possibility.

Another effect of the war taxes, particularly the excess profits tax, is that the effective rate base of a utility upon which it can succeed in earning, as contrasted with the rate base which might be fixed by regulatory authority and upon which it might be permitted to earn, is practically established by tax statute. Whether the average income or the invested capital basis of computing excess profits tax liability is used, an effective ceiling has been put on utility earnings. Further, if the invested capital basis is used, that method practically establishes the deduction of straight-line depreciation reserve. This condition is brought about because the equity invested capital as defined by statutes includes the money and property paid in for capital stock, and the accumulated earnings and profits at the beginning of the taxable year. This statute provides also that equity capital is to be reduced by the distributions made prior to the taxable year which were not out of accumulated earnings and profits.

Now, the accumulated earnings and profits for tax purposes may be, and frequently are, different from the book record of earnings and profits. Many utilities have recorded small depreciation allowances on their books. For tax purposes they have been allowed substantially larger straight-line depreciation expense. When the earnings are adjusted to cover the higher tax depreciation expense, it will be found in many instances that, on the basis of tax returns, distributions have been made, not out of accumulated earnings and profits, but have been paid from capital, and statutory equity invested capital is accordingly reduced.

Thus, when utility earnings over a stipulated percentage of invested capital are subject to an 81 per cent excess profits tax, and the equity invested capital gives substantial effect to straight-line depreciation expense accruals, then, in an indirect way, the deduction of straight-line depreciation reserve has substantially been compelled.

Income taxes have always operated as somewhat of a deterrent of equity financing of utilities, as interest has been a deductible expense for tax purposes. Under the new revenue act, equity financing will be still more difficult. Interest expense is deductible for normal income and surtax purposes. Only one-half of

the interest may be deducted for excess profits tax purposes under the invested capital method. Preferred dividends are deductible in computing surtax net income. The tax advantage of these deductions during this period of high tax rates constitutes an incentive to do additional financing with interest-bearing or fixed dividend obligations. Certainly, from a tax viewpoint, there is no incentive to issue common stock.

Lowered common stock earnings likewise affect the possibility of equity financing. In many instances common earnings will be reduced substantially below the point heretofore required to attract capital. It may be that investors, confronted with low returns on bonds and preferred stocks, and mindful of some of the advantages of equity holdings in the event of inflation, would be willing to invest in common stock even though returns were low. However this may be, the immediate prospective outlook for common stock financing is not bright.

The utility industry generally has a rather high ratio of fixed interest and dividend obligations. State commissions and federal agencies have for some time directed efforts toward improvement of this situation by getting a greater portion of common stock in the security base, either by debt reduction programs or by financing in common, and utilities have cooperated in these aims in many instances.

It is unfortunate that the current high taxes have an adverse effect on these activities; yet it seems unavoidable when the necessity for tax revenues is considered.

Another effect of war taxes is the stimulus which they give to public ownership of utilities. Publicly owned utilities are exempt from many taxes, including federal income and excess profits. This tax differential has always existed. However, under the present high federal taxes, it becomes very marked, and substantial tax savings can be shown to be obtainable under public ownership.

In addition to that, specific tax exemption is granted in the Revenue Bill of 1942 to nonprofit public utility corporations meeting certain conditions prescribed by statute. Among these conditions is the requirement that no benefits shall accrue to any shareholder, and that the property of the utility corporation, after payment or provision for payment of all debt, shall be transferred to and become the property of the United States, or any State, or any political subdivision, agency, or instrumentality thereof which may be authorized by law to accept and operate the properties for the benefit of the public.

At the same time that high tax savings may be obtained through public ownership, the provisions of section 11(b) of the Public Utility Act of 1935 may require certain holding companies to dispose of some of their operating subsidiaries. Because of tax savings which can be effected, public agencies can afford to outbid anyone else to obtain these properties. In fact, it seems safe to say that sales of utility properties are practically limited to public agencies because of high taxes. Thus, indirectly, public ownership will be aided and abetted by war taxes.

The vast majority of the public has repeatedly demonstrated that it does not view with favor public ownership of utilities. I hold no brief for or against public ownership. I merely comment that if public ownership is desired, it should be brought about directly by vote of the local people rather than indirectly through a tax bill.

Private ownership of utilities may be one of the casualties, or at least a shell-shocked victim of the war. If this is so, the Revenue Bill of 1942 may be termed a "task force" to obtain that objective.

Prime Movers Committee Meeting at New York, Nov. 30-Dec. 1

J. A. Keeth, *Chairman*

WITH the exception of interim reports of members representing the utility industry in the work of the American Standards Association and the National Board of Fire Underwriters in the formulation of codes on Pressure Piping and Pulverized Fuel Systems, respectively, the meeting of the Prime Movers Committee held in New York, Nov. 30 and Dec. 1, was devoted to a Round-Table discussion of 29 operating and maintenance problems of current importance and to descriptions of experience in the initial stages of operation of two of the super-pressure boiler installations that have been placed in service in recent months.

One of the topics causing immediate concern is the recruiting and training of power plant operators during the national emergency. A tendency to lengthen the work week is evident, especially in areas where there is much war work in progress. The internal policy of member companies as to transfers between departments, the use of female workers, and aptitude tests for plant operators, were prominent features in this discussion.

Plant operators appear to have successfully handled boiler steam pressure and system frequency during the practice blackouts that have been staged in this country. Load decreases of up to 60 per cent of total system load have been encountered. In general, it seems that the rate at which load returns after a blackout is about the same as the rate at which the load decreases, although the final load is somewhat less than would have occurred had there been no blackout.

The prevention and removal of deposits on steam-turbine blading continues to be of general interest; practice in washing with caustic soda and at reduced steam temperature was discussed in this connection. The treatment of lubricating oil, removal of scale from condenser tubes by the application of acid, safe minimum turbine loads, and turbine alignment, were other topics discussed concerning turbo-generators.

In the field of boiler experience, the problems of sealwelding of rolled tube joints, the cracking of economizer tubes undergoing frequent banking of stoker-fired boilers, and experience with desuperheaters for the control of steam temperature, were matters discussed at length.—J. R. BAKER, *Secretary*.

Utility Commercial Departments an Anchor for Private Enterprise

By C. E. Greenwood
Commercial Director, Edison Electric Institute

WHEN this war of metals and machines hit business the first to feel the repercussions of government restrictions on the use of metals for other than war requirements were the automobile and electrical equipment industries. Steel, copper and nickel became precious metals, and metal working labor was required for the essentials of war equipment.

Among the numerous utility adjustments was the curtailment of electrical sales and promotional activities due to restriction on manufacture and distribution of equipment. Dead-line dates for cessation of production were set by WPB in rapid succession for different classes of appliances; refrigerators, then laundry equipment, ranges, water heaters, table cooking devices and lighting fixtures. The Board extended the time for manufacture of this civilian equipment in some instances for the expressed purpose of making it possible for manufacturers to lay up a reserve of repair parts that would be needed for the duration to sustain the vast body of these electrical servants in homes.

Forward-looking manufacturers with an objective of keeping their name and trade-mark in public favor now, and in the peace-time period, took advantage of this opportunity in order that they might have a supply of material to serve those who had invested in their equipment. Every electrical device represents a special service to the owner. In everything mechanical there is normal wear and tear. Therefore a call from the consumer for maintenance service is an indication of the usefulness of the service being given. "Taking good care of the things you have" as applied to electrical equipment places an obligation on manufacturer, utility and dealer, in cooperation with the consumer.

The "more abundant life," a theme of President Roosevelt to impress the immeasurable value of electrical living, has not been relegated to limbo. Freezing by WPB of refrigerators, ranges and other equipment in dealer stocks was an order intended primarily to first give the benefit of such electrical equipment as remained unsold to those engaged directly in the war effort. The second step was the release of major electrical equipment not required for that purpose to those who had no similar service, an effort on the part of government to extend the benefits of electric appliance services to the greatest number of people.

It was not surprising that when criticism came from government bureaus aimed at continued promotion by electric utilities, that there was a first impression created of inconsistency. Here we had a public of millions at once eager to get such electrical servants as were available without interference with the war effort. Yet they needed guidance in what and how they could buy. They needed to know the facts about power supply in their own communities to operate the equipment. All agree that the quickest informational medium is advertising—in newspapers or direct-by-mail —to spread ideas which will be helpful in harmonizing customer "wants" with emergency restrictions.

Therefore the suggestion that the utilities cease their promotional efforts needed clarification. Factually, the intent of the suggested sales promotion death sentence, as far as concerned government opinion, was to eliminate only the promotion and sales of new electrical products which is better known in our industry as the *merchandising* function. But there is no requirement to eliminate the entire gamut of customer relationships which are functions of the commercial department and included under this accounting misnomer—*sales promotion expenses.*

There is obviously a need for changing this title which is not expressive of the commercial activities of the utility company, the cost of which are included under it.

Now it has been conservatively estimated that the domestic class of users of electric service alone has invested in electric appliances to an amount equivalent to the capital invested in power plants in the United States—expressed in figures an amount approximating fifteen billions of dollars. These customers consider this appliance investment a part of their electric service and hold the utility morally responsible for its upkeep, and expect help from the companies when other agencies fail. This responsibility is but one obligation of commercial men in their customer relation and dealer relation activities.

Winning a war does not necessitate the lowering of morale through denial of the help and comfort that only electrical service can give. The experience of the British, after three years of conflict, the severity of which is now a matter of historic record, is not one of curtailment of household electric service. An increase of approximately 12 per cent in the use of electricity for domestic service during the war period to date has been registered in that country.

Experience teaches that in war-time, electrical living takes on added value. The energy output in the United States has increased approximately 7½ per cent in the past year. There can be no question of the importance of curtailment when and where this energy use is needed for production purposes, but as authorities have pointed out, the probability of such drastic demand as to require rationing the householder is fairly remote in most areas.

Customer relationships with the company are even more vital under present conditions than in normal times. Commercial departments of utilities have the obligation of continuing public relations on even keel at a time when restrictions justified for winning the war are rocking the boat. Of course many adjustments must be made, and the utility can contribute to a more rapid public effectiveness of the restrictive orders of government. This applies not only in the homes, but throughout commercial establishments and in industry. The utilities are alert to this need.

Again commercial men are in the thick of the fight for production of all war material. Utility engineers have worked diligently in order that electricity, which

is the key to production, will be supplied in full measure. Incidentally we have not seen any Army-Navy "E's" awarded to any utility. At the same time, the power sales engineers have been actively engaged in rendering helpful advice in the application of this power to get most effective results. This is not an interim job. It is a commercial service that must be rendered through continuous contacts with industry. Also there is a wealth of information for the power sales engineer in the study of new things and new ways of doing things, and in the study of improvement in generating equipment using other fuels, knowledge which will be helpful in future relationships with industrial customers.

Power sales engineers were an assistance in obtaining the information required in the change-over from civilian to war production. They are to be just as valuable in the change-over to come in the peace-time period. They helped in the national survey of tool facilities which was the forerunner of sub-contract allocations.

Much can be contributed by the power men to the work of saving the "small plants." It is estimated that 169,000 out of 184,000 manufacturing plants in the country employ fewer than 100 workers. The majority of the latter employ fewer than 20 persons. It is a safe bet that most are customers of the utility. Here is a class of business from which the mortality can be high. Helping these smaller companies to survive will advance emergency production and help our war economy.

And what about the utility lighting engineers? Because of the important role of electric lighting for production and for a score of combatant uses, in addition to civilian lighting control, their counsel is essential in many war-time projects. This last mentioned phase of lighting control for civilian defense has required profound study in all the coastal areas. Dimouts and blackouts are not so popular with the public that they can be readily accepted without the inspiration of patriotism. Adjustment has been difficult because of the many conflicting viewpoints in orders and their application. Utility commercial men through contact and clarification have been of greatest assistance in finding a solution to the problem.

Although the merchant cannot be sold additional lighting he can be helped to make the most efficient use of what he has, through the advice of lighting men. Assistance is given also in the maintenance of lighting equipment.

Coming back to the home, one of the major activities contributing to both public and company welfare is to sustain normal electrical living behind the blackout. Better lighting equips for better fighting. Likewise better lighting makes better workmen, better students and better home-makers. The price of light is cheap as compared with its immeasurable value in the protection of the eyesight of the armed forces and civilians alike.

Utility commercial men have an obligation to forward such educational work in all fields of effort for the duration of this world conflict, and in the years ahead. It is of pertinent interest to point out that the price per kilowatthour for electricity is now one-half the average price during World War No. 1 and becomes a lesser item for consideration in the household budget. People must be made to realize all the facts, and be guided in harmonizing their own interest with the vital regulations which the war effort must bring and which affect civilian activity.

Proceeding further we realize the step-up of our Army and Navy forces to seven to ten million will make the problem of feeding the more staggering. American forces are scattered world-wide. Therefore required food production includes the supply for our fighting forces, plus civilians, plus countries that feed out of the United States' bread-basket, plus losses in shipping. No wonder the clarion call for maximum food production from our farms and everything that Victory gardens may add.

In the midst of this unprecedented demand, the farmer calls for help with fewer helpers to answer. Therefore utility commercial men in rural areas must show how electricity can take up the slack. Fully realizing the restrictions placed on new farm machinery including much electric equipment, practically an 80 per cent reduction output over 1940, there are still many jobs to be done electrically on the farm with available apparatus.

How unfortunate the situation where the farmer can obtain but limited apparatus at a time when he needs it most and his financial position is best. The commercial forces are set to help the farmer obtain apparatus required, and also to serve as an agency for assistance in repair and maintenance of present equipment. There is encouragement in the announcement that WPB states that the manufacture of repair parts will be kept at normal level.

Since the Pearl Harbor catastrophe, factory expansion has been without equal and with it the building of defense housing for the workers. There has been a net increase this year of over seven hundred thousand domestic consumers in both rural and urban districts at a time when the extension of electric service, and negotiations for it, have demanded the resourcefulness of commercial executives. The job is not complete. There will be more hurdles to make.

As pointed out in earlier paragraphs, government restrictions as applied to the supply of both electric service and equipment have required interpretation to the public—such subjects as the failure to obtain equipment, the confusion in repair and maintenance, and miscellaneous lighting restrictions.

In the domestic classification of the utility business is included the greatest number of people needing guidance—the greatest number to make satisfied customers through contact. Among the twenty-seven odd millions, commercial men are rendering a coordinated service with government. For example, one finds constant reminders of the individual's duty to help win the war through an investment in Victory through purchase of War Bonds and Stamps. The new theme of the Modern Kitchen Bureau advertising—LUCKY ME! I'M AN AMERICAN—being used by electric utilities in the promotion of War Bonds, is a new approach to their sale. There is an *investment* appeal to save now to spend later, and this has received praiseworthy comment from representatives of the U. S. Treasury Department.

Home Service workers of our companies are contributing to the better health of the nation through assistance in the National Nutrition Program and are giving constant help to customers along informational lines for conservation of household electric equipment. These activities are undertaken not in the spirit of getting a pat on the back, but as a duty.

At the end of our first war year the average energy output per residential customer stands at 1024 kilowatthours. We passed the one thousand mark last spring without marking the achievement with any form of praise. It is to be desired that utility executives give credit to the intensive educational and selling activities of their commercial de-

(*Continued on page* 32)

War-Time Functions of Commercial Sales Departments

The Importance of Keeping Contact with Commercial Establishments, Improving Lighting Conditions, Rendering Service on Repairs and Maintenance of Existing Commercial Equipment

By H. G. Isley

General Sales Manager, Carolina Power and Light Company, Raleigh, N. C.

A paper presented before the General Sales Conference of the Southeastern Electric Exchange, Birmingham, Ala.

IN normal times a utility sales department has two major functions:

(1) to secure the maximum increase in revenue at commensurate cost by selling new and added services and encouraging longer hours of use of present equipment and

(2) to retain all business served by preventing competitive inroads, abandonment or curtailment of equipment due to defective appliances, improper use or lack of understanding and appreciation of its benefits.

The first major function has been very definitely cast aside for the duration and there is no likelihood that it will return until the war is over. We clearly recall the request of our government that every utility discontinue all sales promotion activities aimed at the creation of demands for utilization equipment and increased use of service. This request was closely followed by many priorities and limitation orders affecting the supply, installation, and service of equipment and appliances.

The second major peace-time sales function has likewise faced many barriers since Pearl Harbor, the greatest of which have confronted those assigned the responsibility of holding commercial revenues to their present level. The numerous restrictions imposed on the manufacture, supply, installation, and service of commercial equipment plus the numerous curtailment and rationing orders, multiplied by the draft of personnel into the armed forces, create a problem which makes it extremely difficult to solve.

As I see it, today's major war-time function for the commercial sales department is to show the customers how to get the most benefits from their present utilization equipment, stressing the importance of taking care of equipment so that it will last until the war is over, and to create an appreciation for electric service which will prompt an expansion of its use when utilization equipment is again made available. This can be accomplished through the diversion of efforts of our commercial personnel who have been trained to sell new and added uses to selling the value and benefits of electric service.

The numerous war-time regulations have in many instances actually aided certain classes of customers served. Industrial and G&M, through the increased production of war goods and the establishment of many military projects, have been materially benefited, thereby reflecting an increase in the sale of energy as well as an increase in revenue. While residential and farm customers are not increasing their usage to such an extent as was customary under peace-time conditions due to the scarcity of utilization equipment, there is a growing inclination among this group to spend more hours in the home and on the farm in seeking the comfort, pleasure, and convenience which are no longer available elsewhere due to the transportation problem. Such conditions are causing an increase in the number of operating hours of home equipment.

A survey of the commercial problems presents a most discouraging picture. Practically every war-time regulation imposed since the beginning of the war has cut deeper into commercial revenues. Moving up the clock for the new War Time, freezing civilian products, curtailing the use of automotive equipment, and prohibiting the distribution of many other critical materials have, with few exceptions, adversely affected the use of electric service in practically every class of business establishment. The average life of commercial equipment is considerably shorter than that of domestic and its likelihood of not being replaced may lead to abandonment, thereby leaving a deeper scar in the revenue column. Filling stations, which have contributed an impressive part to commercial revenue, have in many instances reduced their use of electric service 75%, while many have gone out of business. Automobile dealers who for years have been liberal users of electric service have found it necessary to curtail while a large number has deserted this business. Independent merchants selling furniture, clothing, and hardware have cut their operating expenses to the bone, utility services included, while many are no longer finding it possible to remain in business.

The purpose of presenting this dark picture is to place emphasis on the importance of carrying out the major war-time functions, namely, to help the customer make better use of his present equipment so that the maximum benefits —economy and convenience—will be realized during the period when such needs are greatest.

The reduction in residential sales personnel has been met very favorably through the employment of mass selling. One of the features of this technique is the use of group meetings which supplants quite satisfactorily individual calls. Attempt was made to apply such a program to the commercial field in an effort to solve the problem of man power and transportation brought about by warring conditions. It was concluded that in the commercial field there is no satisfactory substitute for personal contacts—individual calls.

An analysis of the needs of the average commercial customer and the service that can be rendered during this period by the commercial representative should disclose many opportunities confronting the representative in making a call. In many difficulties there are many opportunities, and representatives should be quick to recognize such opportunities during this critical period. It should be borne in mind that some day this war will be over and every call made during the period of restrictions should be de-

signed so as to create a need for an expanded use of electric service when that day arrives. I feel that we are all mindful of the fact that there will be many thousands of surplus kilowatts released by war industries when the demand for war goods ceases.

Our company has experienced many serious personnel problems and today the entire sales department consists of personnel numbering about 40. This represents a reduction of approximately 70% under peace-time strength. Insofar as the limited personnel of my company will permit, commercial customer contacts are made regularly, at which time one or more of the following functions is performed:

(1) A survey is made of all electrical equipment in use, its condition, the extent to which it is being used, and plans for use as it relates to that individual establishment.

(2) Lighting levels are determined and whenever and wherever circumstances disclose the need for better lighting, and such can be had without the use of critical materials, recommendations are submitted. In all instances the cleaning of glassware, the employment of idle sockets, and the installation of proper lamp bulbs are urged.

(3) Special emphasis is placed upon the care of all equipment, noting any defects or needs for service. Assistance is offered the customer in securing such service.

(4) Among garages, plumbing and electrical contracting establishments, all of which have suffered severe losses in business due to war-time restrictions, effort is made to enlist the interest of those qualified or who indicate their interest in expanding their service facilities so as to include the maintenance and repair of electrical appliances and equipment.

(5) War-time regulations and restrictions are discussed and assistance is rendered the customer in securing preference ratings needed in the purchase of repair parts and other critical items to keep equipment in operation.

(6) Record is made of any equipment needed with a view of assisting the customer in locating such equipment which has been made available as a result of business casualties. At the same time a list of any serviceable equipment which is not needed by the customer is made with a view of placing it elsewhere in a territory where it may be of service.

(7) Eating establishments, drug stores, theaters, recreational centers, hotels, hospitals, and essential offices have a need for lighting service during evening hours. This need continues through blackouts and for that reason special information is given this group on the construction of light traps and other installations necessary in continuing the lighting service during such periods. At the same time all commercial establishments employing window, decorative, sign, and outdoor lighting are advised of the importance of installing outdoor controls, accessible to patrolmen, wardens, or some person whose responsibility it is to enforce blackouts in that specific area.

Experiences gained from the aforegoing procedure have enabled us to adapt our program which was originally designed for flexibility to meet the changing needs. It was discovered that among many business casualties there was made available numerous pieces of utilization equipment which were oftentimes needed among other commercial establishments, either for replacement purposes or expansion. In this there arose an opportunity to serve the distressed customer by relieving him of the idle equipment and favor the other customer by placing him in a position to secure such equipment. The result of such a transaction enabled us to recapture the revenues lost from the business casualty.

In order that this service could be broadened to include all commercial customers in our area, a special section of our monthly dealer magazine was reserved as a trading post which carries the "For Sale" and "Wanted" items as it relates to our territory. This program was adopted within recent months and is proving to be very effective, rendering the kind of service which is appreciated by the purchaser as well as the seller, and at the same time enabling us to keep that equipment in our territory, equipment which under present-day conditions is no longer available from the manufacturer or distributor. Among the many items which have changed hands during recent months are refrigerated display counters, walk-in boxes, water coolers, air conditioners, heavy duty cooking and baking equipment, counter cookery appliances, motors, and the like.

Many commercial enterprises and tenants in office buildings continue to move from one location to another, some changes of which are likely to result in the abandonment of utilization equipment. We have found it to be very effective to follow very closely such transfers with a view of placing back into service wherever possible any equipment which apparently was not transferred at the time the changes were made. A careful follow up usually results in recapturing this potential loss as a result of stressing the value and benefits from its use.

Right at this point I should like to compliment the Commercial Section of the Edison Electric Institute on the effective educational material which they have made available within recent months. I have in mind the Food Service News which we use as a hand-out piece in calling on eating establishments. The theme of conservation of foods and critical materials is followed throughout the preparation of this material. We have found it to be very useful among all of our commercial cooking customers and they look forward to the monthly issues, for they have found it to be very valuable in helping them to take care of their equipment and enjoy a higher efficiency in its operation.

The territory which my company serves in the Carolinas has in it many crossroad communities, and small villages. There was a time when these communities had drug stores, movie houses, hardware and farm implement stores, general dry goods, and other similar types of business. The good roads made it possible for those living within close range of these communities to purchase the major part of their requirements in larger towns and cities, leaving practically no business for the little villages and crossroads. They dried up. It is only reasonable to believe that without tires or gas these neighborhoods and communities will not be able to make their purchases from the cities like in recent years and must again turn to these "ghost" towns for service. It seems to me that these communities and villages will be born again and every commercial establishment will again have a need for electric service. This should not be at all fatal to the city establishments and they, too, will remain users of electric service. In larger cities more neighborhood stores and recreation centers will spring up in an effort to serve more people with the same reason underlying it . . . that of the "ghost" town . . . and those of you who serve only cities can be a little optimistic toward this end.

Even with the revival of ghost towns, the increased use of service among certain establishments in defense area, and the spreading out of other types of business to reach neighborhood areas, there is little likelihood of additional revenue being secured in sufficient volume to offset the many casualties taking place week after week. However, there is an opportunity to get closer to your commercial customers, to influence their thinking as it relates to post-war planning to the end that a broader use of electric service will be embraced in their plans. The sacrifices which they are making today and tomorrow in an effort to help win this war will no doubt make them all more appreciative of the benefits accruing from an unrestricted use of electric service. The more it hurts them to do without, the more determined will they be in carrying out their plans at the end of the war. In the face of all these difficulties there appears a great opportunity for us to promote the use of our service on an unlimited scale when peace comes and the bars are let down.

T. and D. War Problems Solved by Ingenuity Under Spur of Necessity

Some Emergency Developments May Be Retained as Good Practice After the War

The information on pages 13-19 was abstracted from a round-table symposium on the solving of war-time problems of design, construction and operation held by the Transmission and Distribution Committee at Cincinnati, October 19 and 20, 1942. Contributors to the round-table discussion include Messrs. C. E. Bathe, A. S. Brookes, T. J. Brosnan, G. A. Clark, A. E. Davison, W. R. Doar, R. L. Dodd, H. A. Enos, L. R. Gaty, A. L. Malmstrom, D. F. Meyers, F. W. Nimmer, W. F. Nimmo, P. B. Stewart and H. E. Stites.

Various War Time Expediencies

The territory which we supply is urban and suburban with practically no really rural load. One problem in the city involved the extension of our 66 kv system. This normally would have been done by underground cable. It is now proposed to build an aerial line on wood poles along city streets. This could not be called ingenious, but it saves more than 70 per cent of the copper, all of the lead and paper, and uses less iron and steel. Additional materials required are only wood and porcelain. The ground wire will be omitted and full use made of the additional impulse level which can be obtained with proper construction. Incidentally wood pole construction instead of steel tower has been used in the suburban area with considerable saving in critical materials and in cost.

Additional 13 kv feeders have been added to the larger substations and generating stations by connecting two feeder cables to one station section. This involves some operating handicaps, but saves a substantial amount of material.

Ratings of station positions and cables had previously been standardized so as to eliminate a large number of ratings with small differentials. At present these are being changed to "War Ratings" which reflect the maximum obtainable on a thermal basis. Cable and duct bank ratings have been reviewed and increased to maximum values. Higher ratings are assigned in many cases even though the load factor on individual cables and the average duct bank load has increased greatly.

Spare capacity is being absorbed by adding normal loads to cables which in the past had been partially or entirely held for emergency service. This can be done without entirely eliminating the reserve service by utilizing the short time emergency capacity of the cables to carry breakdown load.

Repairs are being made in all possible cases to put old or damaged equipment in serviceable condition. One item that has saved a substantial amount of critical material and resulted in improved life is the replacement of the bottom portion only of subway transformer cases that have become severely corroded instead of replacing the entire tank.

Experiments are being conducted on pulling out 15 kv cable which has a badly damaged sheath and having it reimpregnated and releaded. The old lead is salvaged so that the only new material required is for impregnation. The results so far have been satisfactory, although experience is insufficient for a final conclusion. Cable which has failed in service is luffed out and either repaired, or the bad section cut out and two or more sections spliced together with duct splices to obtain useable lengths.

Changes in design have saved large amounts of steel. Creosoted timber and crushed stone is being used for many foundations in place of reinforced concrete. Wood structures are being used for substation construction in place of steel. In general, the design we have used is such that each upright is a pole supporting a piece of equipment. No structure used has exceeded two poles with cross timbers. The interlaced structure similar in design to the conventional steel structure has not been used. This construction eliminates steel, saves a considerable amount of timber, improves the appearance and is less likely to be severely damaged from fire or lightning.

Many thousand feet of series street light wire have been pulled out and made available for other service by using the common neutral as a return for part of the circuit.

Ratings of bare copper conductors have been investigated and new ratings developed after the results of laboratory tests, field conditions and Weather Bureau records were analyzed. These new ratings are from 15 to 20 per cent higher than those formerly used, which were previously thought to be quite generous. As an example the rating of No. 4 bare stranded was increased from 190 amperes to 220 amperes for normal loading. Some very interesting information was obtained from an analysis of the Weather Bureau records on wind and temperature.

An ingenious solution was worked out for the supply of two large single phase furnaces from a four wire 4 kv system. A Scott-connected transformer bank was specified for the furnace supply and connected to the three-phase wires. This improved the regulation so that satisfactory service could be given, whereas with a straight single phase connection to each welder the regulation would have been excessive even though they were supplied from different phases.

There have been a large number of things done during the past year to reduce the amount of new material required. Some of these involved reusing existing materials, some working the existing materials harder and some substituting non-critical materials for the more critical items. Ingenious methods have been used in some cases, but in many it is a case of thinking along new lines, of getting out of a mental rut, of exploring other ways of doing the job instead of thinking "that is the way it always has been done." Some cases have required working closer to the ultimate limit by more accurate information obtained by field or laboratory tests.

Tripping Device on Time Switch for Blackouts

One of the many problems we faced in arranging for blackouts as ordered by the Office of Civilian Defense, was the control of series street light circuits where the Anderson Time Switch is employed.

We found that the standard tripping arrangement on this switch is inadequate for use by air raid wardens because it is not only a very delicate instrument but most difficult to reach in the limited time allowed.

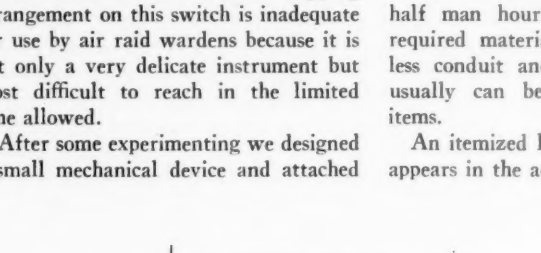
After some experimenting we designed a small mechanical device and attached it to the main body of the switch frame in accordance with drawings appended, which operated manually trips the switch on and off with precision and effectiveness.

The time consumed to make and assemble this mechanism is one and one-half man hours and the cost of the required material is only a few cents, less conduit and lock; which material usually can be procured from scrap items.

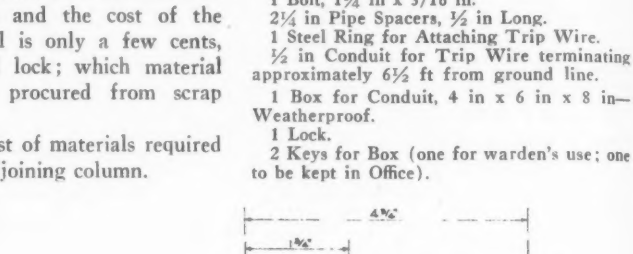
An itemized list of materials required appears in the adjoining column.

Material Required

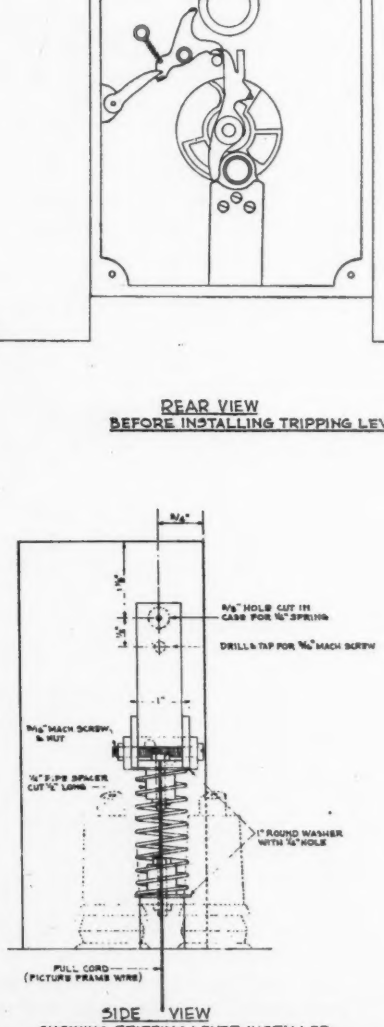
1 Ft Flat Iron, ⅛ in x ¾ in.
7 Machine Screws, 3/16 in.
2 Braces, 1 in x 1½ in x ⅛ in.
1 Tripping Spring, 1½ in x ¼ in.
1 Automobile Valve Spring, (we used inner valve spring from Buick automobile).
1 Trip Cord, Picture Frame Wire.
1 Bolt, 1¼ in x 3/16 in.
2¼ in Pipe Spacers, ½ in Long.
1 Steel Ring for Attaching Trip Wire.
½ in Conduit for Trip Wire terminating approximately 6½ ft from ground line.
1 Box for Conduit, 4 in x 6 in x 8 in—Weatherproof.
1 Lock.
2 Keys for Box (one for warden's use; one to be kept in Office).



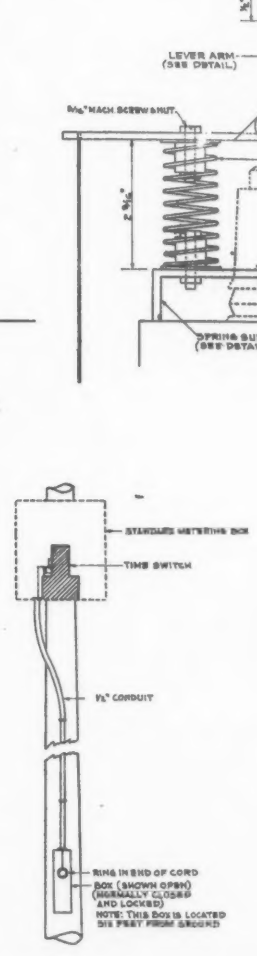
REAR VIEW
BEFORE INSTALLING TRIPPING LEVER



REAR VIEW
SHOWING TRIPPING LEVER INSTALLED


⅝" HOLE CUT IN CASE FOR ½" SPRING
DRILL & TAP FOR 5/16" MACH SCREW
5/16" MACH SCREW & NUT
¼" PIPE SPACER CUT ½" LONG
1" ROUND WASHER WITH ⅜" HOLE
PULL CORD (PICTURE FRAME WIRE)

SIDE VIEW
SHOWING TRIPPING LEVER INSTALLED


STAINLESS WEATHER TIGHT BOX
TIME SWITCH
½" CONDUIT
RING IN END OF CORD
BOX (SHOWN OPEN) (NORMALLY CLOSED AND LOCKED)
NOTE: THIS BOX IS LOCATED SIX FEET FROM GROUND

METHOD OF MOUNTING ON POLE

Drawings showing manual tripping attachment installed on Anderson time switch tripping mechanism type L 25 amps. 6600 volts No. 26052.

How Service Was Made Available to War Production Plant with Minimum Use of Critical Material

This story begins with the application received from two customers for 60 cycle service in the amount of 1500 kva each, in order to permit war production expansion at both plants. These two customers will be referred to as "A" and "B" in the remainder of this report and are shown by these same designations on Figure 1.

There was no such capacity available in the general 60 cycle distribution system in that particular neighborhood. In fact, the nearest point where such capacity was available was at a station more than four miles from the plant locations.

Overhead line construction between the station and the plants was practically impossible because of the congested nature of the neighborhood. The only alternative was an underground 22 kv circuit in existing conduits. This underground installation would have required about 11 tons of copper and 40 tons of lead.

About the time the above services were under discussion we had the opportunity to review with another customer some distance away, the general operating conditions in his plant. This customer is shown as "C" in Figure 1. This customer "C" is now supplied by a 22 kv, 350 MCM, 25 cycle circuit from Terminal Station "C," which is located on the station property. The route of this 22 kv circuit is shown on Figure 1. The total load taken by this customer at the present time is about 7500 kva.

Offhand, there would seem to be little relationship between a 22 kv, 25 cycle customer located on Military Road and our desire to make 22 kv, 60 cycle service available to two prospective customers on Tonawanda Street. However, it is interesting to see how the two worked in together.

In the first place, we found that about one-half of the total customer "C" load or about 3750 kva was being converted to 60 cycles through frequency changers. The customer was not only experiencing high operating costs with the frequency changers, but also experienced high losses in this equipment and in the 440 volt circuits between the frequency changers and his induction furnaces. It was obviously beneficial for customer "C" to obtain a direct 60 cycle supply for the 3750 kva of furnace load and at the same time retain the 25 cycle service for the other half of his load.

The plan was worked out to convert the 22 kv circuit supplying customer "C" to 60 cycle operation by extending it back to a feeder position at the power station. This not only made 22 kv, 60 cycle service available to customer "C," but also made it available about 1½ miles from customers "A" and "B."

The 22 kv, 25 cycle service to customer "C" was re-established by re-routing the four 22 kv circuits that supply substations No. 20 and No. 14 through another existing underground conduit which passes directly in front of customer "C." It was then possible to supply the 3750 kva of 25 cycle load from the reserve capacity in two of these circuits. The final arrangement of the circuits is shown in Figure 2.

The new route of the four cables to Station 14 is considerably shorter than the former one and the re-routing of the four cables released enough cable to convert the original circuit to customer "C" over to 60 cycle operation and to extend it to customers "A" and "B."

In order to accommodate this plan, customer "C" had to install new transformers to replace the voltage transformation previously provided by the frequency changers. On the other hand, the rearrangement released for sale by customer "C," 3-1500 kva frequency changer sets and 2-3000 kva transformers which were previously used between the 22 kv, 25 cycle service and the frequency changers.

This complete plan received the approval of the WPB and the installation is now nearing completion.

Carrying through the plan involved the removal of 38,000 feet of cable and

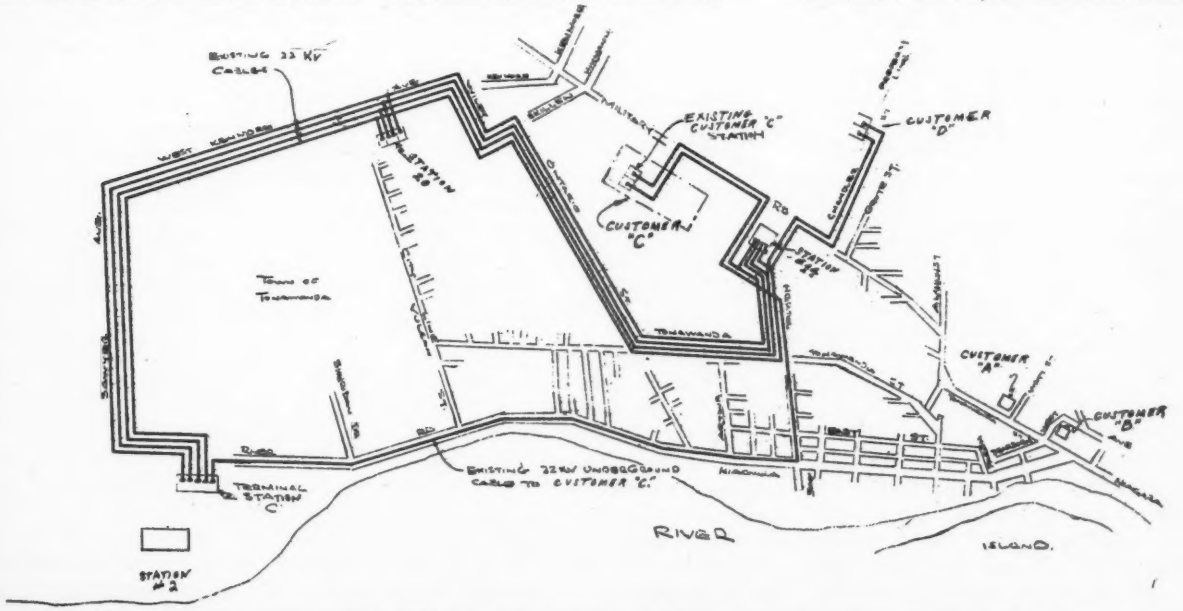


Fig. 1—Underground cable facilities forming portion of 22 kv, 25 cycle system, before relocation.

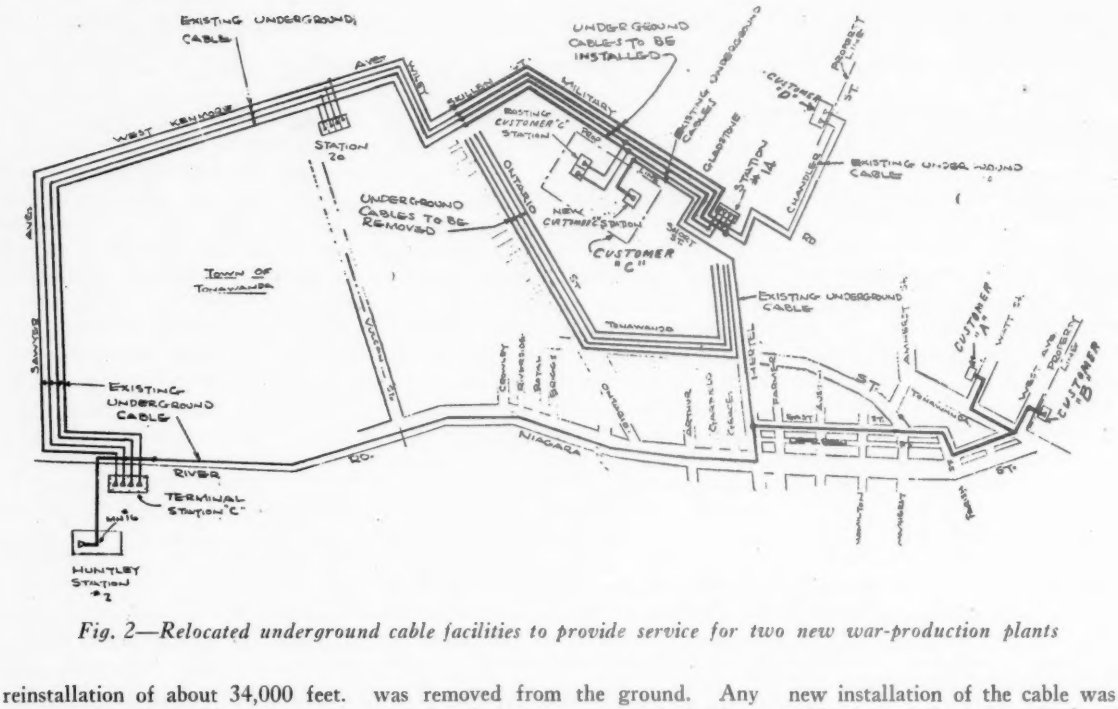


Fig. 2—Relocated underground cable facilities to provide service for two new war-production plants

the reinstallation of about 34,000 feet. This meant that about 90 per cent of the cable removed had to be reused. Rather complete facilities were set up in the field for inspecting the lead sheath and testing the condition of the paper insulation on each piece of cable as it was removed from the ground. Any lead sheath damage was repaired wherever possible by lead burning. Careful planning of the entire project has resulted in salvaging for reuse about 95 per cent of all the cable removed.

An interesting side light is that the new installation of the cable was made with about 1/3 of the splices sealed by means of lead burning and the remaining 2/3 by means of wiped joints using small quantities of solder. As a result, about 1600 lbs. of solder were salvaged by the cable relocation project.

Graphic Performance Analyzer for Distribution Voltage Regulators

A graphic analyzer for use on distribution voltage regulators which has given remarkable and accurate results has been developed by E. D. Hartzell and R. C. Thompson of the Central Illinois Public Service Company.

This analyzer produces a graphic strip time chart which shows the range and number of regulator operations. This chart shows what portion of the available regulation band is being utilized and the frequency of regulator operation. From this definite and accurate information, the following can be ascertained:

By analyzing the graphic charts, it can be definitely determined if the operation range is such that the regulator may be reconnected for 5 per cent operation thereby doubling the ampere capacity of the regulator, or, if the regulator could be replaced by a smaller regulator of 5 per cent regulation thereby releasing larger equipment for use elsewhere.

It can be readily determined from the chart if the regulator is operating primarily on the raise or lower portion of the regulation band and if the transformer taps are set to obtain the maximum use of the regulator.

The frequency of operation gives an indication as to whether the contact making voltmeter's contacts are properly set. In some cases, the frequency of operation will definitely point out the need for time delay equipment. This applies to the older type of regulators which are not so equipped.

In case of system trouble of local nature, the charts will aid in diagnosing the cause of this trouble.

It can readily be seen that the major portion of the guesswork in regulator operation and setting can be eliminated, thereby increasing the return on the dollar invested in regulating equipment.

The equipment required to make this analyzer consists of one recording wattmeter, two potential transformers, one auxiliary transformer, one loading transformer and one variable resistor, connected as shown on the accompanying wire diagram.

The wattmeter used was a standard three-phase, zero center scale, graphic meter equipped with standard 5-ampere current coils and 115-volt potential coils and giving a full scale deflection of 500 watts. The potential transformer across the series winding of the regulator has a turn ratio of 2:1 and is well insulated for use on 2300-volt circuits. A standard 20:1 ratio potential transformer usually connected to the load side of the regulator for the voltage regulating relay is used also to provide the current to the loading transformer which is connected to the current coils of the wattmeter. A 1500 ohm adjustable resistor is used in this circuit in order to provide adjustment for various voltage bases.

The error correcting transformer is

used to vary the loading transformer current to compensate for the difference in potential between full buck and full boost positions of the regulator.

The following example shows what exists at three different positions of the regulator; i.e., neutral, maximum raise, and maximum lower, using a regulating voltage of 2300 volts as base.

When the regulator is in neutral position there is no voltage across the series winding of the regulator, consequently, there is no voltage across the potential coils of the wattmeter, therefore, the meter indicator rests at zero in the center of the scale.

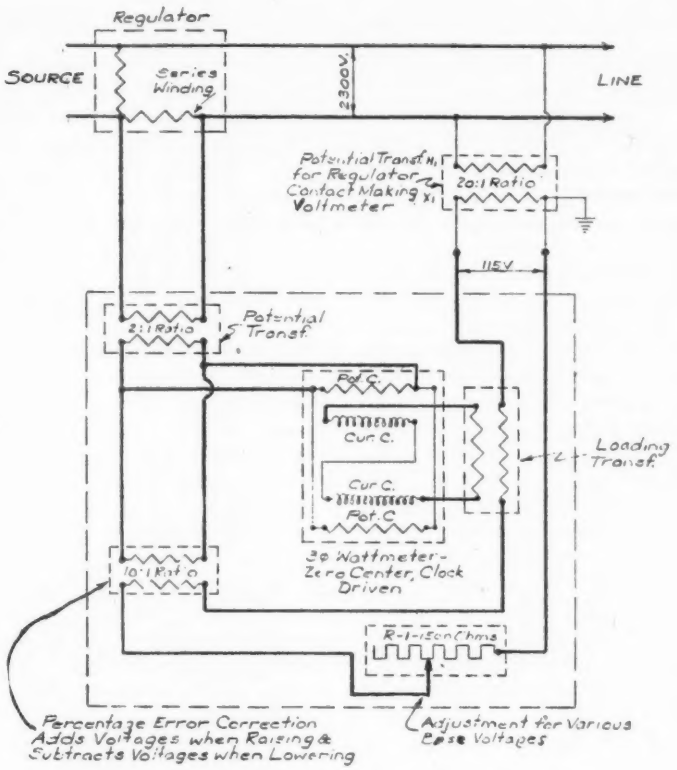
At 10 per cent boost there is 2091 volts input, and 10 per cent of 2091 is 209 volts added which equals 2300. With 209 volts across the series winding of the regulator there exists due to the 2:1 ratio potential transformer, one-half of 209 volts or 104.5 volts across the potential coils of the wattmeter. The current coils were set for full scale deflection at 4.34 amperes, which at 115 volts gives 500 watt or full deflection.

The error correction transformer adds 10 per cent of 104.5 or 10.45 volts to 115 volts, giving a total of 125.45 volts on the loading transformer, thereby increasing the current in the current coils of the wattmeter to 4.75 amperes. This multiplied by 104.5 volts gives 496 watts for full scale deflection which is less than 1 per cent error.

At 10 per cent buck there is 2555 volts input and 10 per cent of 2555 is 255 volts subtracted which equals 2300. With 255 volts across the series winding of the regulator there exists due to the 2:1 ratio potential transformer, one-half of 255 volts or 127.5 volts across the poential coils of the wattmeter.

The error correction transformer subtracts 10 per cent of 127.5 or 12.75 volts from 115 volts giving 102.25 volts on the loading transformer, thereby decreasing the current in the current coils from 4.34 amperes to 3.87 amperes. This multiplied by 127.5 volts = 494 watts for full scale deflection on a 500 watt chart.

Further information on the construction details of the three special transformers may be obtained from E. D. Hartzell or R. C. Thompson of the Central Illinois Public Service Company at Beardstown, Illinois.



Wiring Diagram for Distribution Voltage Regulator

Construction of 26.4 Kv Transmission Line on Narrow Right-of-Way

An unusual transmission line construction problem arose recently in connection with providing 26.4-kv service to an oil pipe line pumping station. It was decided to serve the customer by a three-mile tap to an existing line, using the pipe line right-of-way for the new construction. The pipe line right-of-way was only 6 feet wide for a portion of its length which made it impossible to use our standard construction with a 10-foot crossarm.

Our standard construction utilizes one phase as a shielding conductor with a lightning protector tube installed to drain off direct stroke currents. The two unprotected phases are installed below the shielding conductor with sufficient insulation to the protector tube ground lead to prevent flashovers. Measurements of ground resistance are used to determine tube spacings. Spacings of 750 feet are usual with ground resistances of about 25 ohms. Use of this construction has resulted in reductions up to 90 per cent in lightning outages.

To retain the lightning protection advantages of the standard construction and yet meet the requirements of the narrow right-of-way, post-type insulators were mounted directly on the side of the pole with 3-foot vertical spacing between the upper and middle conductors and 5-foot spacing between the middle and lower conductors. To prevent flashovers from the tube ground lead to the lower conductors, the lead was held out from the pole by a two-foot wooden outrigger installed just below the middle insulator. To compensate for the decrease in insulation caused by omission of the wooden crossarms, it was necessary to install a protector tube on every pole although the ground resistances were below 10 ohms. The use of No. 6A Amerductor (one galvanized copper and two galvanized steel strands) made it possible to use 350-foot spacing with a majority of 45-foot poles.

Similar construction has been used in other cases where clearance was a problem.

Salvaged Fir Crossarms for Line Material Devices

This company has a large stock of used 10 foot fir crossarms not suitable for reissue. They had been used with clamp pins only and still have a good percentage of sound timber in them. Such timber is reprocessed to make several items of line material ordinarily made of steel and porcelain.

Wood Secondary Racks made from parts of used fir crossarms, are used for all 120-240 volt secondary wires smaller than No. 1/0. They are fastened to poles with one through bolt and one 7 inch lag bolt for straight line mains, and with two through bolts for dead-ends. The strength is adequate. The leakage under the worst soot and rain conditions is only 2 milliamperes, which falls off to zero in less than 30 minutes, as the rack dries out. Each one saves 6.5 lb of steel. See figure below.

Wood Secondary Spacer Racks made from parts of used fir crossarms are 1¼ inch square and have three one inch diameter grooves. Each one saves 3 lb of steel.

Wood Braces are made from parts of used fir crossarms for straight line crossarms, side arms, and alley arms. No metal parts are used except 3/16 inch rivets to prevent splitting near the bolt holes. They have other advantages besides the saving of large amounts of steel.

Secondary Dead-ends for 120-240 volt mains on crossarms are made on eye bolts, instead of yokes with porcelain spool insulators. Under extreme conditions there is some leakage, as with wood racks. Each one saves one pound of steel.

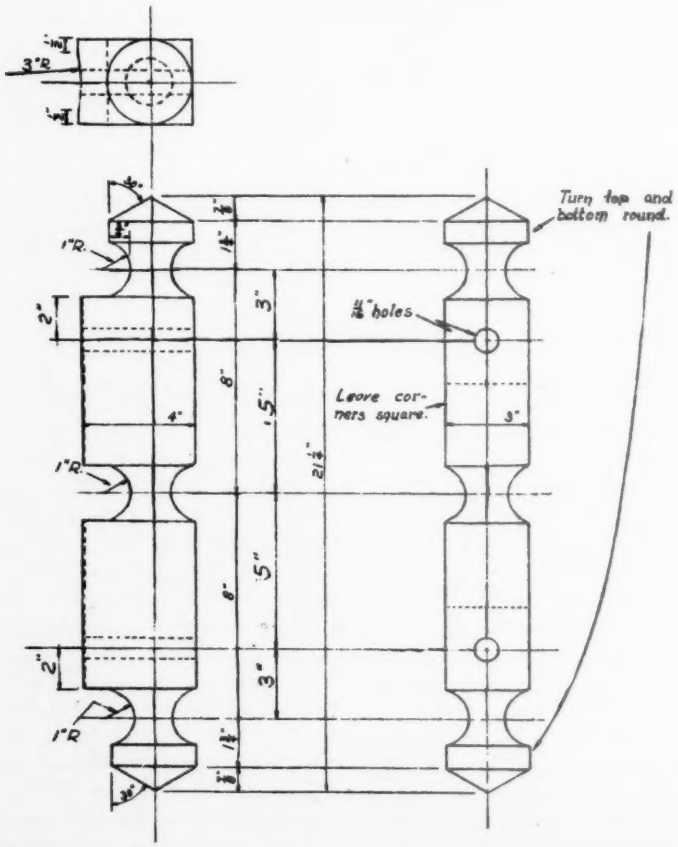
Flat Steel Crossarm Braces used on short crossarms on rural primary lines are conserved by using only one per arm, where the load is balanced on the arm. When the stock of these braces is used up, wood braces are substituted.

Primary Neutral Dead-ends are made on secondary yokes instead of the larger primary yokes. Each saves 1 lb of steel.

Guy Guards, made from used fir crossarms, and painted white, are now used to the exclusion of galvanized steel guy guards. Each saves 12.5 lb of steel.

Concrete Cone Anchors, 8 inches and 16 inches in diameter, are used in place of steel anchors of the same sizes, for the same loads. They have rims one inch thick and no reinforcing. Tests indicate the importance of adequate washers with hardwood or asphalt cushions, to avoid crushing the concrete at the bottom side. Each 8 inch anchor saves 5.5 lb of steel, and each 16 inch anchor saves 31 lb. of steel.

The total of all of these changes will result in important economies and save over 20 tons of steel a year in our company.



Secondary Rack made of salvaged Douglas Fir dressed and creosoted

Increasing Copper Capacity at Low Cost

With the advent of construction limitations, one job of line improvement which we had scheduled definitely for 1942, after being postponed for several years because of the press of other work, could apparently not be done. The line in question was a 2400 volt circuit, several miles in length, connected to a hydro plant bus. The construction plans, prepared several years ago, called for the addition of another arm of conductor which, because of the height and condition of the lead, required an almost complete line rebuild. The necessity of conserving critical material, however, ruled out the desired line and service improvement. Nevertheless, operating and service conditions had become so poor that relief had to be provided in some form or other beyond the addition of booster transformers to a circuit already regulated. It was found that the addition of No. 6 wire and miscellaneous accessory materials within the $500.00 P-46 limit would affect enough improvement to give relief from the intolerable conditions which existed. To the extent that the dollar limitations permitted, No. 6 copper was installed on the same insulators with the existing conductor and complete rebuilding of the pole line was thus avoided.

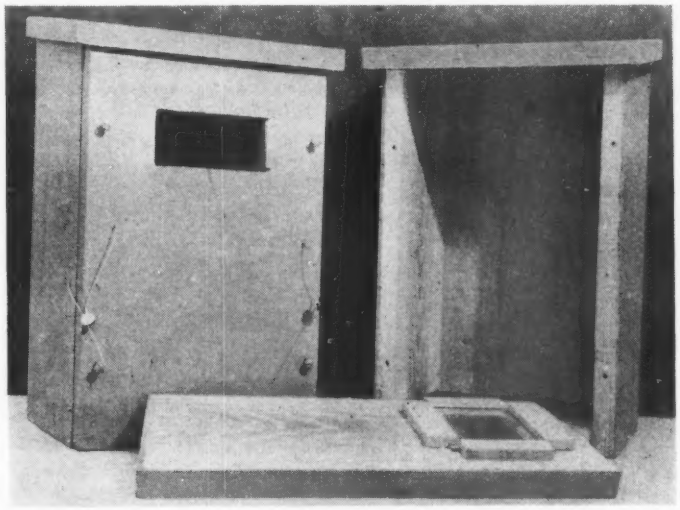
The two conductors on the same insulator are bare tied and thus bonded together at every insulator support. This, together with the fact that the line is at low voltage and is located in sparsely settled territory is perhaps the reason we have not received radio complaints.

Preparation of Salvaged Copper for Redrawing

In connection with copper, we are stripping some old No. 4 and No. 2 wires, welding pieces together to make reel lengths. The reels are shipped to the mills and the wires drawn to No. 8 and No. 6 sizes.

Outdoor Meter Installations

Until recently all of our residential meters were installed on the outside of the customers' homes, using conventional socket type meters and sockets. A few A type meters were installed outside in metal boxes. Due to the freezing of new meters, sockets and metal boxes, we found it necessary to use several thousand old meters which were on our storeroom shelves. In order to use these old meters on the outside of residences we have used approximately 2,500 wooden meter enclosures which are simply wooden boxes with a small window built in the front section. The accompanying pictures give some idea of the simplicity of these boxes. The first 1,000 boxes cost one dollar each but due to the scarcity of suitable lumber we are paying 50 per cent more now. The door of the box can be removed by removing four wood screws. A small hole is drilled at an angle through each side of the front and sides so we are able to seal the enclosure effectively. We expect to use several thousand of these boxes during the next few months.



Outdoor wooden meter enclosures—one company has used several thousand of these simple boxes enclosing old meters installed principally in war-housing developments.

Distribution Transformer Modifications

Older types of distribution transformers being overhauled are modified in various ways to provide for direct pole mounting. In order to minimize the use of adapters, we do not attempt to preserve the standard spacings between mounting bolts adopted by the industry. The procedure in general involves cutting mounting bolt slots in mounting straps or the addition of slotted straps between mounting studs. One result of the procedure is the salvage of some of the old hangar irons for scrap.

3-Phase Transformer Mounting Using One Pole Per Transformer

For a number of years we have frequently used a certain design of three-phase distribution transformer station wherein the transformers were hung on a structural steel assembly in turn supported by two poles. The primary bus was enclosed in iron conduit. In order to conserve structural steel and conduit, we have designed a station using three poles with one transformer installed on each pole and using open wiring on both the primary and secondary busses. We have also recently designed a compact two-pole station for one installation where available space was limited. The design of all three of these types of station has been based on installing 100-kva transformers as the maximum size. Omitting items of copper and steel that are identical in the three designs, remaining copper and steel usage compares as follows:

Type of Station	*Bus Copper*	*Structural Steel*
Convention 2-pole	175 lb	820 lb
Special 3-pole	185 lb	265 lb
Special 2-pole	150 lb	230 lb

Coordination of Automatic Air Brake Sectionalizing Switches with Terminal Oil Circuit Breakers

Another scheme to avoid the use of oil circuit breakers has been the application of automatic air break sectionalizing switches coordinated in operating time sequence, with the terminal oil circuit breakers of a tie circuit. In one installation, a load was connected approximately midway between the terminals of a 42 mile, 66,000 volt circuit. Automatic air break switches were installed in the 66,000 volt line on each side of the tap substation. Operation of the terminal oil circuit breakers and automatic air break switches was arranged so that two oil circuit breaker reclosures are attempted, in order to pick up the line after transient faults. If a permanent fault exists, both automatic air break switches then open, then each terminal oil circuit breaker recloses and the one energizing the unfaulted line section holds. The corresponding air break sectionalizing switch derives a potential indication through a capacitance coupling device and recloses and restores service to the tap substation. The total sectionalizing time is 1 minute 15 seconds.

Standardization on 6.6 Ampere Lamps for Series Street Lighting

Previously, we have always accepted as a matter of course that 20 ampere lamps were necessary for sizes 6000 lumen or larger. Recently, due to the cost and difficulty of getting auto or insulating transformers, we have eliminated their use on all replacement installations with such satisfactory results that in the future, unless unforeseen troubles develop, all of our series street lighting will be at 6.6 amperes.

Our present stock of larger sized constant current regulators is very limited and where defense areas require additional street lighting we have used, with excellent results, two methods of increasing the capacity of existing installations:

1. Install another small constant current regulator connected in parallel with the primary of the existing regulator and in series with the 6.6 amp street lighting circuit. Both regulators are controlled from the present switching equipment.

2. Connect a 3 or 5 Kva 2300/600 volt distribution transformer in the same manner. This will give approximatel/ 4 Kva

(*Continued on page* 32)

Utilization Engineering for Large Agricultural Customers

By E. G. Stahl
Pacific Gas and Electric Company

I BELIEVE it was Mr. Wickard, Secretary of Agriculture, who stated some months ago that "food would win the war and write the peace." Now, while the public interest is largely centered upon the production of airplanes, tanks, ships, and guns, we all recognize the importance of maintaining an adequate food supply for ourselves and allies, and of providing a continuous flow of fiber, oils, and other farm products to supply our war and necessary civilian needs. I say we recognize that fact, but I am wondering if we really do, because we have asked the farmer to do all of these things and then we have told him he can have neither the labor nor the equipment with which to do them. The farmer today is in the most difficult spot of any important industrial group upon which we are depending for the successful prosecution of this war, and every agency that renders a service which is helpful to agriculture is obligated now as never before to make that service as full and complete as it is possible to do.

Largest Farm User

California agriculture depends upon electric power to a greater extent than any other state in the Union. Ninety-five per cent of all farms in the non-mountainous section of this state use central station power. While only 7 per cent of the one hundred million acres in the state of California is farmed to harvestable crops, this area comprising 132,000 farms, which is smaller in area than the state of Maryland, uses more electric power than all of the other 6,000,000 farms in the United States together. How can this be possible? Well, in the first place we have the best climate and the most fertile soil in the world. Red Skelton said, "California soil is so fertile—I stuck a scare crow in the ground and two days later it looked better than I did." As I said, we have the soil and the climate and with a controlled water supply, a large part of which is pumped with electric power, the California farmer is able to produce an average annual income of approximately $6,300 per year compared to an average of $1,900 per farm per year for the remainder of the nation. Electric power is largely responsible for that high income, and wherever we have been able to show a profitable operation through the use of electric power the farmer has been quick to see and take advantage of it.

Twenty Years of Research

For about twenty years the California Committee on the Relation of Electricity to Agriculture, supported by the electrical industry, farm agencies, and the University of California, most of the time under the able direction of Professor H. B. Walker, has conducted research activities and studied economies of operation of electric farm equipment which have contributed much toward this great farm use of electricity in California. Coupled with this work the utilities have trained crews of competent *farm power advisers* who have taken the information to the farmer, studied his problems, and assisted him in making profitable use of his electrical equipment.

It is the work and accomplishment of this latter group in the San Joaquin Power Division which I shall discuss in some detail. This work, of course, applies to electric service for use on dairy and poultry farms, for domestic service, and for other uses about the farm, but my remarks will be confined to electric pumping which is the major use of service on California farms and accounts for approximately 85 per cent of the total electric farm power use.

Two Classes of Irrigation

Irrigation pumping in this Division may be divided into two general classes: low lift pumping where the pumping heads run up to about 100 feet, and high lift pumping with pumping heads from 100 to more than 400 feet.

The low lift territory generally lies on the eastern side of the Valley. The pumping plants are small and in many cases are used solely to supplement ditch water. The season of operation is short, ranging from one to three months of the year, and the problem of efficiency is of lesser importance than in the high lift territory where larger plants are used. The tendency in the low lift territory has been to install plants of larger size than was necessary to meet requirements.

A 15 horsepower plant operating twenty-four hours per day will pump more water than a 30 horsepower plant operating twelve hours per day. With the smaller plant the farmer's investment cost is less, the Power Company's cost to serve is less, the farmer's cost for power will be less, and strange as it may seem even with a small power bill the net profit to the Company will be greater. This is due to the lower demand which is reflected clear back through the generating facilities.

Performance Guarantee

Our men are all trained to determine from the type of soil and the crops to be planted the maximum water requirements for each month, and the smallest plant to meet these requirements is recommended. The plant is purchased under a guaranteed efficiency performance and when installed is tested by our pump testing crews to prove the efficiency before the farmer makes the final payment for the plant, thus correct size of the installation and efficient operating performance is guaranteed. These pumping installations in gravity water territory are very important to the farmers—they supply water when water is most needed, they supply that extra quantity of water necessary for full production and profitable operation, and they tend to counteract high ground water levels which is a danger confronted by nearly all gravity irrigation systems. In this connection, I shall mention that the Division maintains an accurate up to the minute record of ground water levels which shows the danger spots when water levels rise, and it also provides valuable information when new wells are planned.

On the western side of the Valley in the high lift territory conditions are different. Here the farming operations are built around the pumping plant. The cost of water is the major item of expense, the pumping plant investment in many cases is nearly equal to that of the land. A 1500 foot well with a 125 horsepower motor set at a 300 foot lift will cost upwards of $15,000. Such a plant on grain and cotton farming will handle about a section of land. Therefore, in this territory farms are large,

ranging from 640 acres to as much as 50,000 acres per farm, and electric power costs for pumping run from $3,000 to $200,000 per farm per year. The power cost is an important item of expense, second only to labor costs, and amounts to from 7 per cent to 10 per cent of the farmer's gross income. The farmer gives much thought to this item of expense and there is usually an engine salesman lurking in the vicinity to tell him how much cheaper the job can be done with an internal explosion engine.

One Billion Kilowatt Hours

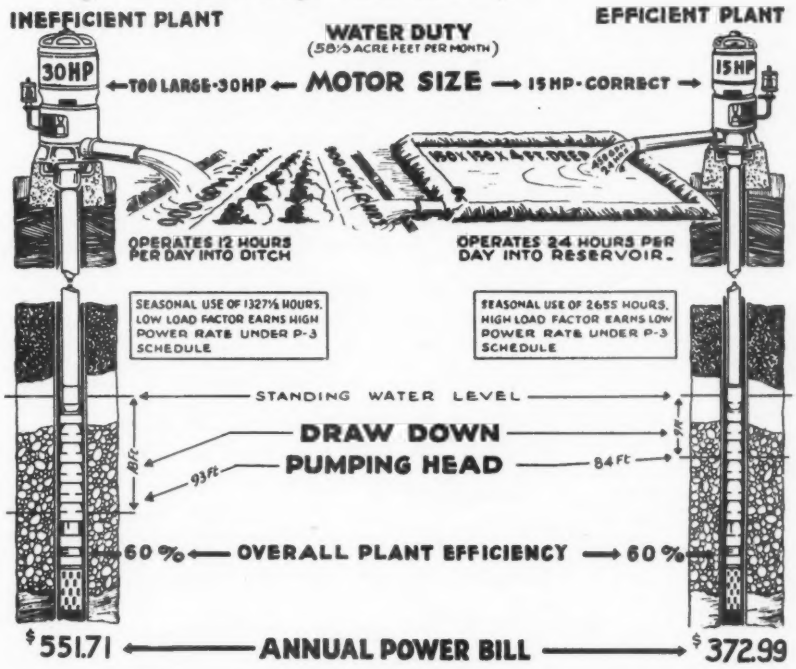
Under these conditions the annual one billion kilowatt hour irrigation pumping load in California did not just come on the line like some of our war load. It was pioneered years ago by such men as A. G. Wishon, who borrowed the money from the bank to finance the first electric pumping installations, and then stuck on the job day and night to make them work. Since that time equipment has been improved, the pump and motor manufacturing companies have done a fine job, utility rates have gone down, better methods of water distribution have been worked out, and information on underground water conditions has been collected and charted for the entire Division.

As a result there has been developed on the west side of the San Joaquin Valley, extending from Los Banos on the north to the Tehachapi Mountains on the south, one of the greatest farm producing sections of the entire world. In this area are farms producing wheat, barley, cotton, and flax with gross incomes as high as $3,000,000 per year per farm; single fruit farms shipping as much as $60,000 worth of fruit per day for months out of the year, potatoes producing $500 per acre, melons this year showing the fabulous return of $1500 per acre. I quote these figures in dollars because I believe they are more understandable that way. They represent quality and vast quantities of food, fiber, and oils so vital in the war effort.

Now, because this remarkable development could not have been possible without water, and because this water is pumped with electric power, the farm power adviser of the Power Company is a key man in this great development. This fact is recognized not only by the farmer but also by the pump dealer and the farm financing agencies. Let's take a typical case and see just what this individual has to do besides secure the application, the contract, the credit statement, the customer's priority approval, and arrange for building the line. Let's assume a new farmer comes into the community, secures a section of land, 640 acres; plans to install a pumping plant and grow cotton, flax, and barley—that is a typical new development. The farm power adviser consults his records, made from some 26,000 pump tests, and determines that in this location the well will probably have to be 1500 feet deep. He recommends a well driller who has had experience in this territory. The well is drilled and a test pump is installed. By regulating the discharge valve the pump is operated at different rates of flow, 600 G.P.M., 900 G.P.M., 1200 G.P.M., and 1500 G.P.M. As the water delivery increases the pumping head also increases. By this method the water make of the well is determined and the farm power adviser can calculate the delivery and the lift at which it will be most economical to operate the pump. This fact decided, the farmer is now ready to enter into a purchase agreement with the pump company with provisions guaranteeing delivery of a certain amount of water at a certain efficiency of operation. The pump is installed, the Power Company crew tests the pump, any necessary changes are made to meet the guarantee, and the farmer is now assured of a definite supply of water, say 1200 G.P.M., at a definite operating cost.

Irrigation Costs Are Affected By Factors OTHER THAN ELECTRIC POWER RATES

(This study is based on an 80-acre farm consisting of 40 acres in grapes, 20 acres in cotton and 20 acres in alfalfa, applying 220 acre feet of water per season. The standing water level in the well is 75 feet and water make is 50 GPM per foot of drawdown. ¶ While these conditions may be different than yours, the same relative opportunity for saving may exist on larger or smaller farms with larger or smaller installations.)


INEFFICIENT PLANT
WATER DUTY
(58.5 ACRE FEET PER MONTH)
EFFICIENT PLANT
30HP
←TOO LARGE-30HP ← MOTOR SIZE → 15HP-CORRECT →
15HP
OPERATES 12 HOURS PER DAY INTO DITCH
OPERATES 24 HOURS PER DAY INTO RESERVOIR.
SEASONAL USE OF 1327½ HOURS. LOW LOAD FACTOR EARNS HIGH POWER RATE UNDER P-3 SCHEDULE
SEASONAL USE OF 2655 HOURS. HIGH LOAD FACTOR EARNS LOW POWER RATE UNDER P-3 SCHEDULE
STANDING WATER LEVEL
DRAW DOWN
PUMPING HEAD
93Ft
84 Ft
60 % ← OVERALL PLANT EFFICIENCY → 60 %
$551.71 ← ANNUAL POWER BILL → $372.99
$6.90 ..... COST PER ACRE $4.66
$2.51 ..... COST PER ACRE FOOT $1.69

The installation shown on the right is properly designed and operated to meet all requirements.

On the left, plant is too large. ~~Pump efficiency also is down and~~ The lift is increased because of greater drawdown, ~~which~~ which increases the cost.

*Water duty varies with different types of soil, as does actual water application. Installations have been found using 11 acre feet of water per year on alfalfa.

This chart is used to show the lower cost of a plant designed for maximum efficiency. Because of more even demand, the lower bill may mean more net profit to the utility.

LOAD FACTOR, UNIT COSTS, ANNUAL REVENUE
AGRICULTURAL PUMPING CUSTOMERS

Customer No. 1—3775 H.P.

Agricultural Season	1930-31	1932-33	1934-35	1936-37	1938-39	1940-41	1941-42
Load Factor	30.4%	44.6%	41.9%	50.2%	49.4%	48.9%	51.0%
Cost Per Acre Foot Per Foot Lift	$.021	$.017	$.014	$.013	$.012	$.012	$.010
Annual Revenue	$45 324	$47.724	$55.124	$70.333	$75,493	$98.825	$111 945

Customer No. 2—1730 H.P.

Agricultural Season	1935-36	1936-37	1937-38	1938-39	1939-40	1940-41	1941-42
Load Factor	49.3%	58.8%	60.5%	80.6%	72.0%	64.0%*	63.4%*
Cost Per Acre Foot Per Foot Lift	$.017	$.013	$.013	$.0125	$.0121	$.0119	$.0120
Annual Revenue	$38 133	$40.918	$49,025	$58.555	$64.776	$58.702	$59,809

Customer No. 3—5851 H.P.

Agricultural Season	1931-32	1933-34	1935-36	1937-38	1939-40	1940-41	1941-42
Load Factor	65.3%	72.7%	77.6%	91.1%	85.1%	71.9%*	70.0%*
Cost Per Acre Foot Per Foot Lift	$.0183	$.0172	$.0110	$.0105	$.0122	$.0113	$.0104
Annual Revenue	$43,600	$47,400	$97,506	$189,188	$203,193	$208,977	$212,339

* *Load factor reduced on account of customer's inability to plant sugar beets. Will be increased during 1942-43 season.*

But the farm power adviser has not finished yet, he must assist the farmer in allotting his water supply to the various crops which are to be grown. He must know his crops and he must know his lands. Some crops are irrigated in the summer, some at other seasons of the year, some crops require more water than others, some soils require more water than other soils for the same crop.

In solving this problem the objective desired, which is in the best interest of both the farmer and the Company, is to secure maximum production by keeping the pumping plant operating day and night for ten or eleven months of the year. Bear in mind this pumping plant represents a large investment, the cost of power to operate it is a major item of expense, and it therefore must be efficiently used, otherwise the farmer will soon be out of business and the Power Company will have an uncollectible bill and an idle investment on its hands.

Efficiency Must Be Maintained

After the pumping plant is in operation it must be maintained at reasonable operating efficiency. Wear on rotating parts and changes in the ground water levels affect both the water delivery and the efficiency of operation. Our pump testing crews are available to test plants and submit reports on water delivery and efficiency, and to make recommendations for improvements. We have found that in order to get the full benefit from these reports they must be carefully explained to the customer by our farm power advisers. Under certain conditions comparative reports may be submitted, showing present cost and expected costs when certain recommended improvements are made.

Operators who have a number of pumping plants keep records of different plants by months, for which we supply the information.

Increasing Hours of Use

In general farming, operations are not fixed as in fruit farming. Crops are changed from year to year depending upon conditions and each change presents a new problem of water distribution. Most large operators have all of their plants tested each year and call in our farm power adviser for consultation on crop water allocations. This has given our men an excellent opportunity to help plan the work so as to increase the annual hours of use of the pumping plants. Now this is an extremely important item to both the Power Company and the farmer. If the use of a 100 horsepower pumping plant, for example, can be increased from 3000 hours operation per year to 6000 hours operation per year, the amount of irrigation water pumped is increased 100 per cent. The cost to the farmer for power is increased only 47 per cent, but the net profit to the Company is more than doubled,* and the result is approximately equivalent to connecting another 100 horsepower and another 75 horsepower plant onto the line.

To provide an incentive for this load factor improvement work, we have established quotas for increased hours of use of existing pumping plants and have given credit against those quotas for accomplishments.

Naturally these are the more spectacular results, but this work extends clear on down to the smallest operating units.

From this brief summary of some of the duties of a farm power adviser it is obvious that he must be something more than just an order taker. His work has been essential to this great agricultural development. It is more important now than ever before in order to help these farmers produce at a maximum rate. This production depends upon a constant supply of water. If, through failure to properly maintain the pumping equipment, the water delivery is reduced, crop production will be reduced in direct proportion. A seven day forced shutdown for repairs on a 1200 gallon pump in the busy season, which could have been avoided, may, for example, reduce the production of wheat by as much as 750 bushels, and 750 bushels of wheat converted into flour will make 48,900 one pound loaves of bread, or converted into butadiene will make enough rubber for 214 six hundred by sixteen automobile tires.

Twenty years ago when maximum pumping heads had reached 100 feet, it was generally believed we had reached the economic limit of water lift for general farming. But, as I previously pointed out, during those years equipment has been greatly improved, power rates have been reduced, and better utilization methods have been employed, with the result that for the past few years flax, barley, and cotton have been produced at a profit with pumping heads up to 400 feet—thus making many thousands of acres of formerly arid land available for agricultural development.

There is still much good undeveloped farm land on the western side of the Valley. The war has slowed down new development work, but after the war is over there will be a great demand for this type of farming land because of its many advantages. We have asked our farm power advisers, during the course of their regular work and without adding to their car mileage, to make a survey of all undeveloped farm land within specified boundaries. They will mark on a map the area and designate the portions that are good farming land. In the Division office we shall insert the type of soil and the water levels. From this information prospective purchasers can be directed to the type of land to meet their farm requirements, and we can estimate in advance the potential load and plan location of lines and substations to supply it.

Right now our important job is to win the war, and some of us who are not in the armed services can make our greatest contribution to this objective by helping the farmer produce.

* Gross revenue 100 horsepower, 3,000 hours operation per year P-3-S schedule, $2800; net profit available for dividends $190. For 6,000 hours operation per year, gross revenue $4150, net profit available for dividends $522—2.75 times the net profit for 3,000 hours use. Taken from cost of service study.

Electricity on the Farm and Its Relation to the National Food Production Program

By C. L. Osterberger

General Sales Manager, Louisiana Power & Light Company, New Orleans, La.

A paper presented at the General Sales Conference of the Southeastern Electric Exchange, Birmingham, Ala., Thursday, Oct. 15, 1942

IN order to consider the relationship between electric service on the farm and the national food production program, it will be well to briefly review this program so as to gain a clear picture of its magnitude and importance. It would also be well to analyze some of the more important factors which are influencing or affecting this unprecedented farm production schedule under full war conditions.

After analyzing the food production program itself, we can then more intelligently see how electric service on the farm *is helping* farmers meet these staggering production requirements despite the many limitations and handicaps which they are facing. No one questions the importance of our food production program in the war effort. Secretary Wickard said, "Food will win the war and write the peace."

Food production is as essential as Industrial production. We must not produce "too little or too late." In fact, war production cannot proceed as required unless there is first an adequate food production schedule. This insures strong, healthy, happy industrial workers capable of doing more. Our men in the armed forces are and will continue to be fed nourishing, balanced meals in ample quantities. Food will continue to flow to our allies. The battle of production on the home front—a food production battle *must be won first!*

What Is the Present National Food Food Production Program?

Last summer, the U. S. Department of Agriculture organized one of the greatest jobs of production planning ever undertaken. These estimates of needs for all farm products in 1942 added up to about 13 billion dollars. This imposing figure is about double the dollar value of electrical equipment production plus automobile and automobile accessory production combined for the year 1939.

Then came Pearl Harbor, necessitating quick upward changes in these already greatly increased requirements. I will show briefly what our 1942 farm production is by giving a few highlights.

American farmers have been asked to produce 125 billion pounds of milk. This is about one quart per day per capita for the United States plus one pint for every resident of the British Isles. This is 108 per cent of 1941 production level.

Some other production requirements are:

Fifty billion eggs—113 per cent of 1941 actual.

About 83 million hogs—110 per cent of 1941 actual.

Increases during 1942 for cotton and corn acreage amount to 108 per cent of 1941 schedules.

Acreage restrictions have been removed on sugar cane.

Soy bean acreage has been boosted to 154 per cent and peanuts have been hiked to 255 per cent over 1941.

Poultry has been upped 110 per cent and cattle 108 per cent.

When all of the increases are added up, it means that in 1942, our farmers must produce about 19 per cent more than was produced during the five years average—1935-1939 inclusive.

The Job Is Big and Presents Big Problems

This is an undertaking comparable to the tremendous production schedules which the President has set for our war industries. The accomplishment of this program is as essential to an allied victory as is the production of guns, tanks, ships, planes and thousands of other industrial products needed in the war effort. It is appropriate to say here, that in doing the job which has been cut out for them, farmers will work under more difficulties than most industries are facing. It would be well for us to consider only a few. Some of the more important difficulties are:

Loss of farm labor—shortage of manpower.

Inadequate supply of horses and mules—shortage of animal power.

Scarcity of tractors and stationary engines—shortage of mechanical power.

Shortages and scarcities of practically everything which farmers need such as farm machinery, fertilizers, buildings, seed, transportation, etc.

Let us consider the first problem—shortage of farm labor. Our farmers use more power than many of our most important industries combined. The secret of our increased production over the past twenty or thirty years lies in the amount of power that is in the hands of, and controlled by, each farm worker. It is not intended to disregard such important factors as better knowledge, better farm management practices, better seed, better fertilizer and many others. These all contribute, but the most important is the progress made in recent years in transforming farm workers from *power units* to *operators* of larger, more efficient machines and power units capable of much greater hourly production.

With the continual migration of workers from farm to factory, plus the loss of thousands to the armed forces, our farmers are now operating with an alarming shortage of manpower.

As evidence of the seriousness of this problem, Governor Stassen on Oct. 9 set up his own State manpower commission in his agricultural state to meet this situation. He said, "One fourth of our farm workers have left. We must do something if America is to have butter on its bread."

Presently, there are about 11 1/3 million persons working in agriculture. This represents about 20 per cent of all persons now gainfully employed. During 1930 there were nearly this same number—some 200,000 less—which represented about one-fourth of all employed in the United States. Further decreases are sure to come in 1943, thus making it necessary to again increase the output per farm worker. The present production index per worker is 160 as compared with a 100 base in 1910.

Now for the second problem—shortage of animal power. In 1910, there were 24 million horses and mules on farms in the United States. This number has steadily decreased due to the influence of tractors, to 14 million in 1941 or 60 per cent. It takes several years to materially increase the supply of work animals and the Army is still drawing upon the present supply. Farm-

ers will, therefore, have to make the most of what they now have or even with something less.

The situation with reference to tractors and gas engines for farm use is not bright. The use of tractors has increased from 1000 in 1910 to 1,800,000 in 1942.

The tractor factories are now making tanks and gun power units, therefore, the production of tractors for farm use is over for the duration and present equipment must be made to last and to work longer hours each day. Generally, this same situation applies to the availability of stationary engines for miscellaneous farm power jobs.

The last group of difficulties and shortages will not be discussed, but it is safe to say that electricity on the farm can help solve some of these problems as well as many others which have been brought out thus far and its our duty to show our farmers how.

For the purposes of this presentation, I believe that the food program with many of its more important problems have been given. However, bear in mind that the output—the production per farm worker, due to improved practices, equipment and increased power facilities on farms, has steadily increased from a base index of 100 in 1910 to 129 in 1930; to 152 in 1940 and to 160 in 1941. The immediate job is to increase the output—the production per worker even more.

Electricity on the Farm Can Help Increase Production and Save Manpower

We in the utility business who serve farm customers have a patriotic duty to perform. We owe it to our farm customers and to our country to do everything practicable to show them "how."

We can no longer build rural lines thus making the manyfold benefits of modern electric service available to additional farms. Neither can we take on loads requiring additional capacity calling for new transformers, metering equipment and vital copper without specific WPB approval. We can, however, do a lot with what we already have.

In considering electric service to farms, there are two natural divisions, according to use:

1—In the farm home.
2—On the farm itself.

We will not dwell upon the scores of profitable uses in the farm home. It is sufficient to say that electricity has done more to bring the living standards in farm homes to a level comparable with the best-equipped city homes than all other factors. This is a well-known social and economic contribution which follows the high lines. Farmers as well as their families realize this and greatly appreciate the value of the service.

It is now impossible to secure new equipment, therefore, farm houses will have to get along with what they now have. Our obligation to these customers and to our companies is to teach them how to properly care for their equipment —how to make it last until the war is won—how to get the most from what they now have.

In doing this, we will help maintain morale and health and save time and energy. All of these factors contribute to a high degree towards *winning the war on the home front.*

With Electric Service, Farmers Have Power Available

The real further contribution which electric service can make to the food program lies in putting it to work on the farm itself. The uses are many, but we will mention only a few.

Barn and yard lighting makes it safer and easier to do the work. It discourages prowlers and thieves. The farm water system automatically supplies an abundance of fresh water so essential to sanitation, health and cleanliness, and increased production in many lines. The small motor will do countless chores and downright hard back-breaking jobs, thus conserving vital and scarce man-hours. Many operations can be made automatic without additional use of much critical material, again saving manpower. Lights and water warmers during the winter months will help meet poultry and egg requirements and this requires no additional manpower. In the dairy, the hay hoist, running water, the milker, the small feed grinder, the ensilage cutter, bottle washers, bottle filling machine and refrigerating equipment all help to speed up production with minimum requirements of manpower. Moreover, the quality of the products are superior and often bring premium prices.

There is little need to go on and on. There are several hundred practical uses on the farm and in the farm home.

The natural reaction to this reasoning is "yes, that's all true, *but*—where can farmers go to get the equipment necessary to put electricity to work on their farms?"

The equipment is either off the market or available to a very limited extent. This is partially true, but farmers can still secure some equipment in both the new and second-hand markets. Moreover, there's an imposing list of equipment, simple things which they can easily and cheaply build or have built. Often the answer lies in simply getting a small motor with two proper size pulleys and a belt and the job is done. A simple heating element or a light bulb and a waterproof socket in the case of a poultry water warmer plus a tin can is all that is needed. The egg candler can be made very easily right at home.

There are scores of plans for simple home-made poultry brooders. It is also a simple matter to build a pig brooder which will save many young pigs farrowed during the winter months.

Our farm publications and our State Agricultural Extension Departments have issued much practical information on the subject of home-made electrically operated farm equipment. 4-H Club boys and girls are interested in these kinds of projects. Adults and Future Farmers of America are interested.

There is no better way to save time and keep equipment in repair than to have a small farm shop. Lighting, a motor and a few simple tools save equipment and much valuable time.

In every community there are automobile repair shops and other types of shops that have gone out of business. They have motors and some other equipment which farmers can use advantageously. The second-hand equipment dealers and motor repair shops still have some stocks. Each of you can determine the possibilities which this field offers in your own territory.

The National Food Production Program requires substantial increase in practically all farm products—nearly one-fifth more total production over the period 1934-39.

The increased food production program will have to be met by the *present farmers* since it is unlikely that new farms could be fully equipped and gotten into production in time to help next year or even for the duration.

Farmers will be required to *produce more* with a continuing *decrease in farm labor.*

Power is a major item in all farm production.

Additional horses and mules, tractors, gas engines, trucks and other equipment will be either out for the duration or difficult to secure.

One apparent partial solution is to place more power in the hands of each farm worker. Transfer to machines and motors all work which can, under present day condition, be done mechanically and automatically, thus stepping-up each worker's output beyond the present 160 index pre-

(*Continued on page* 32)

Electric Metering Methods to Reduce Manpower, Materials and Costs

By A. L. Carvill
Ebasco Services Incorporated

A paper presented at joint meeting of Meter and Service Committee, E. E. I., and Committee on Metering and Service Methods, A. E. I. C., Detroit, Oct. 8, 1942.

MEASUREMENT of electrical service provides a recognized method for the non-discriminatory sale of energy and power, also an effective means for its conservation by restraining use to that which is economical. It is important that satisfactory metering be continued.

However, the conduct of the war requires the utmost economy in the use of manpower and materials and it would appear that an analysis of metering practices of operating utilities might bring out opportunities for substantial gains toward that objective. Such an analysis would include a review of practices developed over extended periods, and requirements of other company departments and regulatory bodies.

The purpose of this paper is to suggest items to aid in obtaining such economies.

Test and Inspection Schedules

Utilize the ability of watthour meters to maintain accuracy for considerable periods of time. Lengthening test schedules will do much toward economizing in both manpower and transportation. Where regulatory authorities specify definite test schedules, application to them, substantiated by the necessary information and data, may provide relief. Several state commissions have recently relaxed testing requirements for the duration.

Single-Element and Small Capacity Multi-element Watt-hour Meters—Lengthen schedule to 96 months for all meters 12 kva or less or where necessary discontinue periodic testing of small capacity meters for the duration. The Code for Electricity Meters, Fourth Edition 1941 (approved by American Standards Association before the war) suggests a 72-month schedule for meters of 6 kva and less. Request has been made of the American Standards Association to lengthen these schedule suggestions for the duration.

Larger Multi-element Watthour Meters—Lengthen schedules as much as practicable, i e 24 months to 32 months; 12 months to 16 months, etc recognizing that certain large installations may continue to require relatively frequent tests and inspections.

Indicating Demand Meters and Registers—*Graphic Demand Meters*—Schedules required for satisfactory operation of indicating meters depend upon local operating conditions and type of equipment used. Economies may be obtained by lengthening test and inspection schedules to a practicable maximum of 3 to 6 years. Periodic removal of charts on graphic meters provides opportunity for necessary test and maintenance at the time charts are changed.

Testing Procedures and Methods

A review of the type of testing equipment that is available and testing methods practiced may indicate possible economies.

Automatic Shop Testing Methods—Utilization of automatic shop testing equipment such as gang test boards, photo-electric and stroboscopic methods will not only increase the number of tests per tester, but will decrease the number of skilled testers required.

Date-Due vs Geographic Testing—Testing residential meters on the date they become due for test does not permit economical routing of work. Testing on a geographic basis, i e testing all meters in any particular area only once during the test schedule period may, because of changes in meter locations, cause some meters to be tested ahead of schedule and other meters to have a period between tests in excess of the schedule. Most companies use a combination of date-due and geographic testing methods, but accent on geographic testing may be justified by savings in manpower and transportation.

Removing Meters for Periodic Test—The use of employees having less skill with such transportation as may be available, for removing meters, also the greater use of automatic equipment in the shop may obtain economies in periodic testing, particularly in rural areas.

Removal and changes of meters entails work and expense which ordinarily should be avoided. When meters are changed from one location to another it often is necessary to change accounting and meter records. Savings usually result from cooperative study by accounting and collection departments and meter departments for the simplification of accounting routine necessitated by meter changes.

The over-all economy of removing meters for periodic test should be judged by weighing the practicability of changing meters plus any resulting clerical expense against cost of testing meters on the premises.

Installation Tests and Inspections—Where regulatory authorities require a test and/or inspection of meters shortly after installation, application may well be made to them for permission to discontinue this practice for small capacity meters for the duration. In most instances regulatory requirements are complied with by testing the meter in the shop before installation.

Where it is the practice to make tests or verification inspections on certain large capacity meters soon after installation, economies may be obtained by having such inspections made by the meter installer rather than to send another meterman to the job for this purpose.

Meter Maintenance—When demand registers and demand meters are found to be in need of repairs, economies may be obtained by removing them for shop service because of their complex construction. This will permit detailed repairs to be made more efficiently and will decrease the idle time of transportation equipment.

It may be found practicable in the interest of conserving materials, to discontinue replacement of parts if reasonably satisfactory performance can be expected until the next periodic test or inspection. For example: it has been the practice in many companies to replace lower bearing jewels if microscopic examination indicates minor wear or subsurface cracks. Lowering of rejection standards in many instances will still permit acceptable performance.

Women Testers—Some companies have found the employment of women testers for shop work to be satisfactory where metermen are not available. They can be trained for this type of work, and are particularly adaptable to the operation of automatic testing equipment.

Complaint Tests and Inspections

Tests and inspections on meters and service equipment to adjust complaints require the services of skilled metermen with transportation facilities. A review of the results may indicate where savings can be made.

High Bill Complaints—Cooperation with customer service and sales departments may assist materially in reducing the number of complaint tests required. Studies of the results of previous complaint tests will show the percentage of cases where the accuracy of the meter was not within allowable limits, or where conditions other than meter inaccuracy caused high registration. Discussions with the customer and a comparison with his previous bills may assist in decreasing the number of cases where a test is requested. Due consideration should be given to any regulatory body requirements that tests be made on customer request.

Low Bill Inspections—It has been the practice in some companies to check service and meter installations where the meter registration appears abnormally low. These practices might now be reviewed to determine if as many such checks are warranted.

Station Metering

Economies are obtained in some companies by having the meter department periodically inspect, test and maintain watthour and demand meters and other instruments used in generating and substations. Studies of present testing and maintenance methods may indicate that lengthening test schedules will permit savings in manpower and transportation. Conference with engineering and operating departments may show that the accuracy of operating records and operating procedures will still be adequate under such increased test and maintenance schedules.

Interconnection Metering

Test and maintenance of equipment used for measuring interchange between utilities is also a function frequently performed by meter departments. With this type of installation, particularly where large blocks of power are measured, relatively frequent test and maintenance inspections may be required. Studies of meter operating results and contract provisions may indicate the practicability of lengthening present schedules.

Utilization of Metering Equipment

The priority, conservation and limitation orders issued by the War Production Board will limit the amount of new metering equipment and maintenance parts obtainable. A definite need is therefore indicated for resourcefulness in the use of available equipment.

Stock Control — Periodic reports showing detailed data on stocks in the various division or district locations will aid in obtaining the most effective use of equipment.

Pooling Spare Metering Equipment — Mutual advantage can be taken of the diversity in needs for metering equipment by pooling information on available spare equipment, by several neighboring utilities.

Metering Equipment Specifications — A compromise with previous specifications on details of meters covering such items as socket or A-type base, lower bearings of ball or pivot type, will be desirable in the interest of utilizing existing stocks, surplus stocks of other utilities, or in obtaining new meters from manufacturers. Similar concessions in specifications for auxiliary metering equipment may also be desirable.

Meter Rebuilding—Rebuilding of metering equipment to make it more useful, such as changing from A-tvpe base to socket base, has been a practice followed by many companies under normal conditions. Restrictions on the availabilitv of materials, particularly socket bases, will necessitate the postponement of such programs for the duration. However, limited rebuilding of meters to increase their capacity or to rearrange their coils for measurement of different types of circuits will be of value.

The use of properlv reclaimed parts, for rebuilding or repairing meters, will aid in the conservation of materials.

Meter Replacement—Replacement of meters in service because of obsolescence in electrical characteristics, or because they are not best suited for modern installation practices, while prevalent under normal conditions, has been discontinued for some time by most companies. Efforts toward utilizing meters presently in service to the practicable limit assist in conserving both labor and material.

Demand Meter Application—The installation of graphic versus indicating demand meters depends upon the billing information need, contract requirements, customers' desires, etc. The original cost and the reading and maintenance costs for indicating demand meters is less than for graphic demand meters and choice calls for cooperation of sales and rate departments. There may be locations where graphic demand meters can be replaced by indicating demand meters and savings effected. When graphic demand meters are required savings may be made by using 16 or 32 day charts wherever practicable.

Record of Sub-standard Meter Installations —The recording of information of substandard meter installations on the meter history card or on other records, will be of assistance in correcting these conditions after the emergency.

Meter Removals and Disconnections

Practices developed as the result of accounting and collection requirements for the removal or disconnection of meters upon vacancy, affect the number of operations performed by meter departments.

Meter Removals—Studies of manpower and transportation required for removing residential meters and disconnecting service drops because of vacancy may show that economies can be effected by leaving the equipment in place for future occupancy. Such removals might be postponed for a period of 6-12 months, except where it is known that the premises will be permanently vacant or where it is necessary to obtain meters for use on other installations. Corresponding savings would be made in the number of required shop tests on removed meters.

Meter Disconnections — Where residential meters are not removed for vacancy, savings may be possible by not physically disconnecting the installation but by leaving service available and the meter connected to register any energy consumed. Several companies have followed this plan with considerable success by having the new customer notify the company when service is desired and by using the previous "readoff" index to start the new billing. With this procedure only one visit to the premises is required because of change in occupancy.

Meter Records

Simplification of meter record procedures conserves time and paper work. A review of the entire meter record and clerical procedures may indicate practicable savings in unnecessary forms, records, reports and clerical operations. Conference with other departments may result in simplification of meter records that are now required for other than meter operating functions. Such studies could well be coordinated with the requirements of regulatory authorities.

Routing of Work Orders

An investigation of the routing of wiring inspection, installation, reconnection, removal, complaint test and other work orders may result in savings in both manpower and transportation, through the grouping of orders to be executed as far as practicable by one employee and avoiding multiplicity of visits to any one area.

Transportation Methods

Need for conserving tires, gasoline and automotive equipment have dictated changes in the use of transportation. Many meter operations may be carried out by utilizing public transportation facilities. Bicycles may be used by metermen in urban areas, where the transportation of heavy tools and equipment is not required.

Organization

The loss of skilled employees and changes in operating practices as a result of the war indicate the desirability of making studies of personnel for the purpose of rearranging the organization to promote the most economy and efficiency.

New Installations

Savings in wiring materials required for service entrance and interior wiring installations will be realized and the connection to new installations will be expedited by cooperating with architects, electrical contractors and others concerned.

Service Entrance Requirements—The War Production Board Defense Housing Critical List, February 2, 1942, outlines the types of wiring materials permissible for use in new wiring installations. Such restrictions in materials and methods may change previous requirements for service entrance installations. Cooperation with electrical contractors in acquainting them with changes in wiring materials and methods will aid in obtaining suitable service entrance installations and facilitate service connections.

Cooperation with Inspection Authorities— It may be helpful to cooperate with inspection authorities by suggesting changes to conform to war emergency changes in the National Electrical Code, and to other desirable exceptions to normal requirements.

Trouble Calls

Employees of meter departments are utilized by some companies for certain types of service outage complaints such as those requiring the replacement of blown fuses on customers' premises. Conference with sales and other departments will assist in developing educational programs to promote the renewal of fuses by the customer, for the purpose of decreasing the outage time to customers and the manpower and transportation requirements of the utility.

PERSONALS

For outstanding service to his community, state and nation, J. E. DAVIDSON, President, Nebraska Power Company and Civilian Defense Commander of Omaha, has been awarded a plaque by the national Veterans of Foreign Wars made annually in Omaha.

In commenting on the Award, the Omaha *Evening World-Herald* said editorially: "Omaha's Veterans of Foreign Wars did a thoughtful and gracious thing when they awarded their plaque for 'outstanding service to community, state and nation' to J. E. Davidson.

"As head of citizens' defense activities in this community, Mr. Davidson has labored diligently and successfully. He has built up an organization which functioned well in the first test blackout and which, it may be expected, will be fully trained and ready to serve in any future emergency.

"In accepting the award Mr. Davidson said humbly: 'In all my activities I have received the cooperation of all the people and various organizations throughout this area.'

"That, we believe, is true. In a sense the VFW award was a tribute to all those good citizens who have been giving their time and energy to the many civilian defense enterprises. But it was preeminently a recognition of the sound and energetic leadership provided by Mr. Davidson."

PAUL A. SCHOELLKOPF, vice chairman of the board of directors of Niagara Hudson Power Corporation since 1933, has been elected chairman of the board of directors of that corporation to succeed the late Floyd L. Carlisle.

Mr. Schoellkopf has been active in the affairs and operations of the Niagara Hudson System and its predecessor companies for the past thirty-five years. He has been a member of the board of directors of Niagara Hudson Power Corporation since 1929 and was its president from 1929 to 1933. He is also chairman of the board of directors of Buffalo, Niagara and Eastern Power Corporation and president of the Niagara Falls Power Company.

Mr. Schoellkopf was born in Niagara Falls, New York, in 1884 and was graduated from Cornell University in 1906.

In 1907 Mr. Schoellkopf became the secretary and treasurer of the Niagara Falls Hydraulic Power and Manufacturing Company, one of the predecessor companies of the Niagara Falls Power Company. In 1913 he became its general manager.

During World War I the several generating and distributing power companies at Niagara Falls were consolidated into the present The Niagara Falls Power Company, and in 1920 Mr. Schoellkopf became its president and has continued in active charge since that time.

In 1925 The Niagara Falls Power Company joined the other major operating utilities in western New York to form Buffalo, Niagara and Eastern Power Corporation, with Mr. Schoellkopf as its president. He served in that capacity until 1929, when he was elected chairman of the board of directors.

WILLIAM B. SKELTON of Lewiston, Me., has been elected president of the Central Maine Power Co., Augusta, succeeding the late Walter S. Wyman. Mr. Skelton, a vice president of the company, was closely associated for many years with Mr. Wyman. He was born in 1871 at Bowdoin, Me., and after being graduated from Bates College took up law and was admitted to the bar in 1893. He began practice at Lewiston. Among his many posts of responsibility have been presidency of the First National Bank, Lewiston, and Androscoggin and Kennebec Railway and of the Lewiston Gas Light Co.; treasurer Union Water Power Co. and Androscoggin Reservoir Co., Lewiston, director Boston and Maine Railroad, Maine Central Railroad, Androscoggin Mills, Bates Manufacturing Company, Hill Manufacturing Company, York Manufacturing Company, New England Industries, Inc., Maine Seaboard Paper Company, New England Public Service Company. Mr. Skelton is a former Mayor of Lewiston and former bank commissioner of Maine and from 1914 to 1919 was a member of the Maine Public Utilities Commission. He first became associated with the Central Maine Power Company in 1922 when he was elected a vice president. He became a director in 1924.

KINSEY M. ROBINSON, president of the Washington Water Power Company, Spokane, has been elected to the board of trustees of the Manufacturers' Association of Washington.

RALPH H. TAPSCOTT, president of Consolidated Edison Co. of New York, Inc., since 1937 has been named the company's chief executive officer by the trustees of the company, thereby succeeding to the responsibilities held by the late Floyd L. Carlisle. Oscar H. Fogg, vice-chairman of the board, was elected to the newly created position of chairman of the executive committee. The offices of chairman and vice-chairman of the board were abolished. The board indicated that in all other respects Mr. Tapscott and Mr. Fogg would perform their respective duties as heretofore.

Similar action was taken by the boards of directors of the other System Companies, of which the late Mr. Carlisle served as chairman, namely, Brooklyn Edison Co., Inc., and New York and Queens Electric Light and Power Company.

In 1917 Mr. Tapscott became assistant chief electrical engineer of the New York Edison Company, one of the predecessors of Consolidated Edison; in 1925 he was made electrical engineer and seven years later vice-president of that company and of the United Electric Light and Power Company. He became vice-president of Consolidated Edison Company in 1936 upon the merger of those companies into the parent company. He is a fellow of the American Institute of Electrical Engineers and has served as a vice-president and as chairman of several of its committees.

Mr. Fogg entered the gas industry with the United Gas Improvement Company in Philadelphia and in 1904 joined the Consolidated Gas Company of New York. In 1924 he was elected vice-president in charge of commercial relations, customer's service and utilization; in 1935, executive vice-president, and in 1937 vice-chairman of the board of Consolidated Edison Co. During the First World War the French Government gave him the Ordre de l'Etoile Noire and the U. S. Government the Distinguished Service Medal.

EDWARD T. GUSHEE has returned to the Detroit Edison Company as assistant to President A. C. Marshall. Mr. Gushee left the Edison Company in 1939, after 19 years of service, to become executive vice-president of the Union Electric Co. and subsidiaries of St. Louis, Mo. He resigned from this position and has been doing war work as a senior consultant with Army Ordnance in Washington.

Mr. Gushee will continue his association with Army Ordnance as a member of the advisory committee of Gen. A. B. Quinton, chief of the Detroit District Ordnance.

PHILLIP V. COLBURN has been appointed to the position of Manager of the Cloquet Division of Minnesota Power and Light Company, succeeding the late W. J. Wilkinson.

Mr. Colburn was born in Cloquet where he attended grade and high school. After a few years employment with the Northwest Paper Company and a short time in general construction work, he became connected with Minnesota Power and Light Company. As a young man he started at the bottom of the ladder in the electric utility business, being first employed in July, 1928, as a groundman on the line crew. From this position he successively worked his way through the various positions of lineman, estimating engineer, line foreman, and in August, 1934, was made Division Superintendent, which position he held at the time of his appointment as Division Manager.

Mr. Colburn has taken an active part in community affairs and recently served in the capacity of President of the Cloquet Junior Chamber of Commerce.

H. P. POLHEMUS, vice president of the Jersey Central Power and Light Company, Asbury Park, has been elected president of the New Jersey Utility Association. He succeeds William H. Roth, who has moved from New Jersey.

HARVEY EDMUND has been elected vice president and general manager of Coast Counties Gas and Electric Company, Santa Cruz, Calif.

ALLAN R. BAILEY, assistant to the president, of Coast Counties Gas and Electric Company has been commissioned Major in the Services of Supply branch of the Army.

C. E. NELSON has been appoined superintendent, engineering division, transmission and distribution department, Philadelphia Electric Co. Mr. Nelson's first position with the Philadelphia utility was as design estimator in the transmission and distribution design section. After five years in design work, he was named superintendent of the service maintenance division. In 1940 he was made division superintendent of the eastern division at Jenkintown. Two years later he was named assistant division superintendent of the Philadelphia division, transmission and distribution department, and held that position at the time of his recent appointment.

A. F. HERWIG, executive secretary of the Wisconsin Utilities Association with headquarters in Milwaukee, has been named chief of emergency utilities of the Wisconsin Defense Council.

New officers of the Iowa Utilities Association recently elected by the Board of Directors are: President, GEORGE NEAL, president, Sioux City Gas and Electric Co.; First Vice President, B. F. PICKARD, president, Interstate Power Company, Dubuque; Second Vice President, C. A. LELAND, president, Des Moines Electric Light Company.

WILLIAM B. BLAKE, for fifteen years associated with the Central States Power and Light Co. and the Interstate Power Company, has been named secretary-manager with offices in the Fleming Building, Des Moines. Mr. Blake is a former state representative from Fayette County, Iowa.

GEORGE NEAL, newly elected president of the Iowa Utilities Association, succeeds Sutherland Dows, president of the Iowa Electric Light and Power Company, Cedar Rapids, who has served as president of the group for a number of years. Mr. Neal's term of office expires January, 1944, at which time Mr. Pickard, first vice-president, automatically assumes office.

J. O. SPEED, director of safety of the Alabama Power Company, has recently been elected chairman of the Alabama chapter, American Society of Safety Engineers.

JOHN W. ANDERSON has been appointed assistant division superintendent, Philadelphia division, transmission and distribution department, Philadelphia Electric Company.

H. G. WINSOR has retired as personnel officer of the Puget Sound Power and Light Company, a position he has held since 1924. The utility loaned Mr. Winsor's services to the government early last year, as Pacific Northwest representative of OPM's training-within-industry program and he moved up to his present position as district director of the War Manpower Commission last July. He entered the service of the Puget Sound at Tacoma in 1913, after spending almost 30 years in the electrical industry in Massachusetts, Michigan and Minnesota. Mr. Winsor is relinquishing his position with the Puget Sound utility in order to devote full time to his duties with the Manpower Commission.

The Puget Sound Power and Light Company has recently announced the promotion of four members of its staff.

K. E. HOLLINGSWORTH will become assistant to Vice-President Patrick Johnson. Mr. Hollingsworth has been associated with several divisions of the company serving at Everett, Seattle, Sumner and Bothell. HARRY KLEIN, who began duty with Puget Sound in Bellingham back in 1928, will collaborate with Mr. Hollingsworth in his new duties. M. A. FOSTER, who has been appointed assistant to Vice-President C. F. Terrell, received his engineering education at Texas A. and M. He also completed Puget Sound's course as a student engineer, beginning his tour of instruction at Wanatchee in 1928. Previous to his present promotion he held the position of assistant superintendent in the light and power department at Everett. H. I. Lewis, who has been connected with the Seattle utility since 1928, has been named assistant to Vice-President Cecil Webb. He received his academic training at the University of Texas. Don F. Misz has been transferred from the general engineering department to Everett to succeed Mr. Foster. He has served Puget Sound for 19 years in various capacities, with experience in southern, western and general office.

L. M. TAYLOR, general sales manager of the Mississippi Power and Light Company, has been named Mississippi chairman of the industrial salvage campaign, undertaken by WPB to stimulate the flow of industrial scrap to the nation's steel mills. The appointment was made by John S. Knox, in charge of the Mississippi operations of the WPB's industrial salvage section.

J. M. HOFF, formerly district manager for the Mississippi Power and Light Company at Lexington, Miss., has joined the staff of the U. S. Engineers at Greenwood, Miss.

More Than Half of America's Families Have Mechanical Refrigeration

THE U. S. Population Census reported 15,093,336 mechanical refrigerators in American homes on April 1, 1940. This number was 43 per cent of the 34,861,625 occupied dwelling units at that time.

The term "mechanical refrigerators" includes those operated by electricity, gas and kerosene and the figure of 15,093,336 compares with the Edison Electric Institute's estimate of 14,480,000 *electrical* refrigerators as of the same date.

Since April 1, 1940, some 5,700,000 electric units have been installed and probably some 900,000 units retired, leaving the present number about 19,280,000. The total number of mechanical refrigerators of all types in service at the present time is probably about 20,000,000, which represents 56½ per cent of the 35,400,000 present occupied dwellings.

The saturation of mechanical refrigerators varies widely in the United States, being influenced as much by consumer purchasing power as by any other factor. The highest is in the District of Columbia, with 77 per cent of the occupied dwellings; the lowest being in Mississippi with only one family out of every seven having mechanical refrigeration. Incidentally it is of interest to note that the area served by TVA ranks among the lowest in the country as far as refrigeration is concerned. The detailed figures, by states, are shown in the adjoining columns and graphically by the chart.

Mechanical Refrigerator Saturation in U. S. A., Apr. 1, 1940

State	Occupied Dwelling Units	Mechanical Refrigerators Number	Mechanical Refrigerators % Dwellings	Electric Customers*	% Rfgs are % Customers
Maine	218,999	62,093	28	185,879	34
New Hampshire	133,010	50,992	38	126,071	40
Vermont	92,432	33,834	37	76,792	44
Massachusetts	1,120,524	557,899	50	1,130,319	49
Rhode Island	187,795	77,898	41	182,837	43
Connecticut	448,887	270,902	60	447,831	60
NEW ENGLAND	2,201,647	1,053,618	48	2,149,729	49
New York	3,662,618	2,209,184	60	3,404,862	65
New Jersey	1,100,585	652,694	59	1,077,844	60
Pennsylvania	2,515,884	1,247,051	50	2,134,556	58
MIDDLE ATLANTIC	7,279,087	4,108,929	56	6,617,262	62
Ohio	1,898,212	966,665	51	1,659,429	58
Indiana	961,500	387,908	40	769,655	50
Illinois	2,193,114	1,161,229	53	1,838,773	63
Michigan	1,396,206	701,204	50	1,272,920	55
Wisconsin	827,265	299,141	36	677,371	44
E NO CENTRAL	7,276,297	3,516,147	48	6,218,148	57
Minnesota	728,513	257,243	35	501,098	51
Iowa	701,920	236,784	34	484,823	49
Missouri	1,068,811	429,909	40	678,386	63
North Dakota	152,171	30,447	20	67,487	45
South Dakota	165,430	39,700	24	79,025	50
Nebraska	360,811	130,884	36	245,718	53
Kansas	511,414	198,181	39	332,873	59
W NO CENTRAL	3,689,070	1,325,148	36	2,389,410	55
Delaware	70,572	34,429	49	52,077	66
Maryland	466,002	219,400	47	510,004	69
Dist of Columbia	173,709	133,471	77		
Virginia	627,659	232,789	37	365,517	64
West Virginia	444,889	172,587	39	254,166	68
North Carolina	789,566	217,079	27	377,028	58
South Carolina	434,922	110,323	25	153,821	72
Georgia	752,286	181,243	24	307,640	59
Florida	520,135	175,357	34	311,136	56
SOUTH ATLANTIC	4,279,740	1,476,678	35	2,331,389	63
Kentucky	698,604	195,408	28	319,812	61
Tennessee	715,425	193,887	27	330,349	59
Alabama	673,914	154,352	23	256,644	60
Mississippi	534,867	76,998	14	138,434	56
E SO CENTRAL	2,622,810	620,645	24	1,045,238	59
Arkansas	495,841	83,333	17	148,883	56
Louisiana	592,595	136,796	23	264,278	52
Oklahoma	610,424	183,779	30	285,966	64
Texas	1,678,674	590,974	35	835,123	70
W SO CENTRAL	3,377,534	994,882	29	1,534,250	65
Montana	159,977	58,471	37	104,074	56
Idaho	141,765	57,773	41	107,198	54
Wyoming	69,357	26,384	38	40,502	65
Colorado	316,112	109,382	35	212,482	51
New Mexico	129,504	33,916	26	49,387(a)	69
Arizona	131,189	51,474	39	86,732	59
Utah	139,496	69,830	50	118,173	65
Nevada	33,294	15,710	47	21,876	72
MOUNTAIN	1,120,894	422,940	38	740,424	57
Washington	537,968	218,222	40	462,614	47
Oregon	337,731	143,398	42	268,019	53
California	2,139,047	1,212,729	57	1,891,234	64
PACIFIC	3,014,746	1,574,349	52	2,621,867	60
TOTAL U S A	34,861,625	15,093,336	43	25,647,717	59

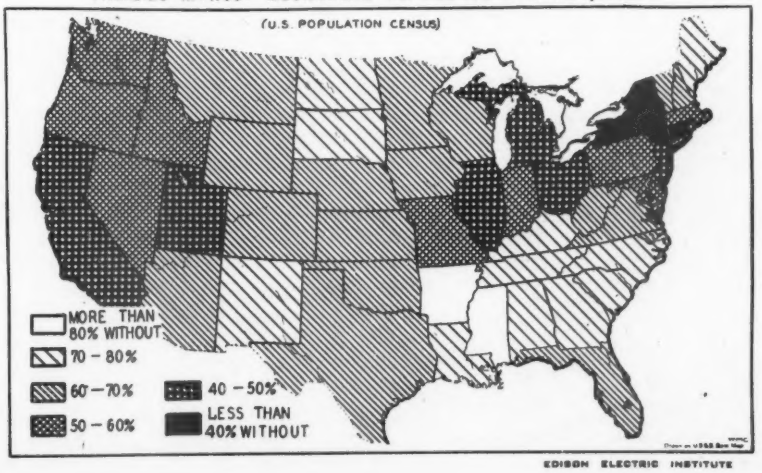
Note *Electric customers as of Dec 31, 1940. Includes both "residential" and "rural" classifications.
(a) Revised figure.

Dr. E. A. White

DR. E. A. WHITE, former Director of the Committee on Relation of Electricity to Agriculture, died at Evanston, Ill., Dec. 6, 1942. Dr. White was born at Antioch, Ill., Dec. 17, 1883. He was a graduate of the University of Illinois and held an M.S. degree from the University of Wisconsin and a Ph.D. from Cornell.

One of the country's foremost agricultural engineers, he was appointed Director of the C.R.E.A. shortly after its organization in 1923, and continued in that capacity until dissolution of the Committee in 1939. The far-reaching experimental work of the C.R.E.A. under Dr. White's direction is credited with equipping agriculture, the electric industry, and the manufacturers of farm machinery with tools and facts without which the widespread general application of electric power to farm operations would have been greatly delayed and handicapped.

FAMILIES WITHOUT MECHANICAL REFRIGERATORS APRIL 1, 1940



E.E.I. PUBLICATIONS AND SERVICE MATERIAL

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Accounting and Statistical

	Members	Non Members
Accounting		
Digest of Authoritative Opinions of the Definition of Original Cost (Including Appendix on "Prudent Investment") 1938	$1.50	$1.50
Proceedings 1942 Meeting of Gas and Electric Accountants	1.00	1.00
Proceedings—National Accounting Conferences		
Complete Set—6th Conference 1942	1.00	1.00
" " 5th " 1941	2.00	2.00
" " 4th " 1940	2.00	2.00
" " 3rd " 1939	2.00	2.00
" " 2nd " 1938	1.50	1.50
by Groups Yearly—		
Classification of Accounts	.50	.50
Customer's Relation	.50	.50
Depreciation	.50	.50
Plant Accounting and Records	.50	.50
Purchasing Stores & Transportation	.50	.50
General Sessions	.50	.50
Summary of Definitions Covering Depreciation and Related Terms 1939.	1.00	1.00
Statistical		
J-2—Electric Light and Power Industry in 1941 (5/42)	.30	.75
I-2—Electric Light and Power Industry in 1940 (5/41)	.30	.75
(Statistical Bulletins also available for years 1932 to 1939 inclusive) each.	.30	.75
Weekly, Monthly and Annual Statistics (Includes Annual Statistical Bulletin; Weekly Electric Power output; Monthly Electrical Research Statistics).	2.00	2.00

Engineering Committees

ACCIDENT PREVENTION—RESUSCITATION

J-9—1941 Accident Statistics of Electric Light & Power Industry (12/42)	.10	.25
F-10—Tree Trimming Practices (10/38)	.20	.50
E-12—Resuscitation Booklets (7/37) 1— 9 copies	.10 each	
10— 99 "	.08 "	
100—499 "	.06 "	
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5,000	30.	
10,000	50.	
C-14—Resuscitation Charts (4/36)	.10	.10
C-12—Twelve Messages on Accident Prevention in the Electric Public Utilities (12/35)	.10	.10

ELECTRICAL EQUIPMENT COMMITTEE

F-13—Reconditioning Flood Damaged Electrical Equipment (12/38)	.30	.75
F-5—Design of Switchhouses for Generating Stations and Transmission Substations (6/38)	.40	1.00
E-1—Rectifier Wave Shape (4/37)	.40	1.00
C-10—Symbols for Metering Diagrams (12/35)	.10	.10
B-10—Electrical Energy Diversion (10/34)	.20	.50

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A-19—Hydraulic Governors (8/33)	.20	.50

JOINT REPORTS

J-8—Utilization Voltage Standardization Recommendations (10/42)	.20	.50
J-6—Wave Shape of Multi-Phase Rectifiers—Engr. Report No. 49—Joint Subcommittee on Development and Research (8/42)	.50	1.25
J-4—Low Frequency Shielding in Telephone Cables—Engineering Report No. 48—Joint Subcommittee on Development and Research (5/42).	.80	2.00
J-1—Positive Disconnection of Distribution Circuits During Faults to Ground—Engineering Report No. 47—Joint Subcommittee on Development and Research (4/42)	.60	1.50
I-9—Standards for Distribution Transformers (Second Report) EEI-NEMA (12/41)	.25	.60
I-8—Susceptiveness of Subscriber Station Sets—Engineering Report No. 46—Joint Subcommittee on Development and Research (12/41)	$0.60	$1.50
I-7—Frequency Weighting for Message Circuit Noise—Engineering Report No. 45—Joint Subcommittee on Development and Research (12/41)	.20	.50
H-12—Neutralizing Transformers—Engineering Report No. 44—Joint Subcommittee on Development and Research (7/41)	.30	.75
H-10—Effects of Bonding Exchange Aerial Telephone Cable Sheaths to Multi-Grounded Power Neutrals—Engineering Report No. 43—Joint Subcommittee on Development and Research (6/41)	.30	.75
H-8—Standard Basic Impulse Insulation Levels — AIEE - EEI - NEMA (1/41)	.05	.05
H-3—Inductive Coordination Aspects of Petersen Coil Grounding—Engr. Report No. 42—Joint Subcommittee on Development and Research (12/40)	.25	.65
H-1—Test Specifications for Household Electric Ranges—EEI-NEMA (5/40)	.20	.50
G-9—Methods of Measuring Radio Noise—EEI-NEMA-RMA (2/40)	.20	.50
F-17—Short - Circuiting Relay Protectors—Engr. Report No. 41—Joint Subcommittee on Development and Research (8/38)	.40	1.00
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F-2—Inductive Coordination of Rural Power and Telephone Systems—Engr. Report No. 40—Joint Subcommittee on Development and Research (1/38)	.80	2.00
E-9—Characteristics of Power System Faults to Ground-Engr. Report No. 39—Joint Subcommittee on Development and Research (11/37)	.60	1.50
E-5—Principles and Practices for Inductive Coordination, EEI-AAR (1/37)	no charge	no charge
E-4—Joint Use of Poles 6.6 and 13.2 kv. Safety Features—EEI-Bell Tel. (1/37)	.30	.75
E-3—Jointly Used Wood Pole Lines Specifications—EEI-Bell Tel. (1/37)	.50	1.50
Power Level and Sensitivity of Telephone Circuits—Engr. Report No. 38—Joint Subcommittee on Development and Research (1936)	.40	1.00
Computation of Zero-Sequence Impedance of Power Lines and Cables—Engr. Report No. 37—Joint Subcommittee on Development and Research (1936)	.80	2.00
Selected Devices for Reducing Harmonics in Power Systems—Part II—A-C Systems—Engr. Report No. 34—Joint Subcommittee on Development and Research (1936)	.80	2.00
D-14—Vol. IV—Engineering Reports of the Joint Subcommittee on Development and Research (1/37)	5.00	10.00
D-13—Vol. III—Engineering Reports of the Joint Subcommittee on Development and Research (1/37)	5.00	10.00

PRIME MOVERS COMMITTEE

J-7—Boilers and Combustion 1941 (10/42)	1.20	3.00
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I-4—Boiler Auxiliaries, 1940-1941 (10/41)	.80	2.00
H-11—Power Station Chemistry, 1940 (7/41)	.40	1.00
H-9—Turbines, Condensers and Associated Equipment (4/41)	.80	2.00
H-7—Boilers—Combustion, 1940 (3/41)	1.60	4.00
G-10—Boilers, Superheaters, Economizers, Air Heaters & Piping, 1939 (4/40)	.80	2.00
G-7—Turbines, Condensers and Pumps (1/40)	.70	1.75
G-3—Combustion, 1939 (12/39)	.80	2.00
F-15—Boilers, Superheaters, Economizers, Air Heaters and Piping, 1938 (12/38)	$1.00	$2.50
F-14—Turbines, Condensers and Pumps, 1938 (12/38)	.70	1.75
F-12—Combustion, 1938 (11/38)	1.00	2.50
E-16—Boilers, Superheaters, Economizers, Air Heaters and Piping, 1937 (12/37)	.90	2.35
E-15—Oil and Gas Engines, 1936-1937 (10/37)	.40	1.00
E-14—Turbines, Condensers and Pumps, 1937 (9/37)	.60	1.50
E-11—Combustion, 1937 (9/37)	.80	2.00
E-10—Power Station Chemistry, 1937 (9/37)	.30	.75
D-11—Turbines, Condensers, Feedwater Heaters and Pumps, 1936 (11/36)	.60	1.50
D-10—Oil and Gas Engines, 1935-1936 (10/36)	.40	1.00
D-8—Superposition of High Pressure Non - Condensing Equipment on Existing Power Stations (10/36)	.25	.65
D-7—Combustion, 1936 (10/36)	.60	1.50
D-6—Boilers, Economizers, Air Heaters and Piping, 1936 (9/36)	.60	1.50
D-5—Power Station Chemistry, 1936 (7/36)	.20	.50
C-8—Oil and Gas Engines, 1934-1935 (10/35)	.50	1.25
C-6—Combustion, 1935 (8/35)	.80	2.00
C-5—Turbines, Condensers and Feedwater heaters, 1935 (7/35)	.40	1.00
C-4—Boilers, Economizers, Air Heaters and Piping, 1935 (7/35)	.60	1.50
B-8—Steam Generation (8/34)	.60	1.50
B-7—Oil and Gas Engines (8/34)	.40	1.00
B-5—Station Piping, 1934 (7/34)	.60	1.50
B-4—Turbines, 1934 (6/34)	.40	1.00
B-3—Condensers, Feedwater Heaters, Evaporators, and Boiler Feed Pumps (6/34)	.45	1.15
A-7—Stoker Equipment and Furnaces (8/33)	.60	1.50
A-6—Pulverized Fuel (8/33)	.75	1.85
A-5—Power Station Chemistry (7/33)	.40	1.00
A-4—Burning of Liquid and Gaseous Fuels (7/33)	.30	.75
A-3—Turbines (8/33)	.75	1.85
A-2—Station Piping (8/33)	.60	1.50

TRANSMISSION AND DISTRIBUTION COMMITTEE

J-5—Ice and Wind Loading Tables for Overhead Line Conductors (Revision of Tables 85 to 96 of the Overhead Systems Reference Book) 1942	1-4 copies	10c.
J-3—Cable Operation 1940 (8/42)	.50	1.25
H-6—Distribution Transformer Load Supervision (3/41)	.60	1.50
H-5—Cable Operation, 1939 (1/41)	.60	1.50
G-5—Cable Operation, 1938 (1/40)	.60	1.50
G-1—A.C. Network Operation, 1936-1937 (8/39)	.80	2.00
F-16—Cable Operation, 1937 (12/38)	.60	1.50
F-10—Tree Trimming Practices (10/38)	.20	.50
F-9—Conductor Sags and Tension for Rural Lines (10/38)	.40	1.00
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D-9—Principles and Practices in Grounding (10/36)	.40	1.00

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MS-3—Specifications for Standard Current Transformers for Primary Circuits (8/42)	.10	.10
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TD-61—Suggestions for Specifications for Type "A" Untreated Douglas Fir Crossarms (11/40)	.10	.10
TD-62—Suggestions for Specifications for Type "B" Untreated Douglas Fir Crossarms (11/40)	.10	.10
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Air Conditioning Installations, 1942 (Summary)	$0.50	$0.50
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G-4—Electric Metal-Melting Furnaces (1/40)	.80	2.00
F-11—Electrification of Oil Refineries (10/38)	.30	.75
C-13 Steam and Electrical Requirements of Hotels (12/35)	.30	(members only)
C-2 Steam and Electrical Requirements of Office Building (4/35)	.30	.75
Power Sales Manual (1941)	3.50	5.00
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I-5 Standardization of Electric Water Heating Equipment (10/41)	.20	.50
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Utility Appliance Maintenance and Repair Programs	.25	.50
Adjusting Home Service Activities to War Time Conditions	.25	.50

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Better Light—Better Sight— Better Production	$2.50C	$2.50C
Better Light—Better Sight— Better Living	2.50C	2.50C
Priceless Eyes	2.50C	2.50C
Facts You Should Know About Your Eyesight	$2.00 per 100	

	Members	Non Members
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"Time to Relight"—(Commercial) sound slide 15 minutes, 85 pictures	$10.00 film & disc	
"Light Up—Step Up"—(Industrial) sound slide 15 minutes, 75 pictures	$10.00 film & disc	
"You Can Do Something About It"—(Home) sound slide, 15 minutes, 95 pictures	10.00 " " "	
Wiring		
Rewiring for Commercial and Industrial Buildings	$0.25	$0.25
Handbook of Interior Wiring Design—1937	.50	.50
Basic Factors of Adequate Wiring —1939	.25	.25
Covered Neutral Cable Helps Sell Adequate Home Wiring—1939	.25	.25
Commercial Building Re-wiring Market—1939	.35	.35
(Price on above three books as a group is 60c per set)		
Films		
Commercial Re-Wiring — lantern slides	Set $17.50	
Home Wiring—lantern slides	Set 25.00	

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Code for Electricity Meters (1941)	$1.60	$2.00
Electrical Metermen's Handbook (1940)	2.40	3.60
Good Radio Reception (1937)	100 copies	4.00
	1000 "	25.00
	3000 "	60.00
	5000 "	95.00
Objective Type Rates, 1933-1936	.80	2.00
Ice and Wind Loading Tables for Overhead Line Conductors (Revision of Tables 85 to 96 of the Overhead Systems Reference Book) 1942	1-4 copies 10c. 5-49 " 6c.	
Power Sales Manual (1941)	3.50	5.00
Rate Book for 1942	10.00	25.00
Rewiring for Commercial and Industrial Buildings (1941)	.25	.25
Sales Training Manual—Commercial Electric Cooking (1941)	$1.50	$1.50
Storm Loading and Strength of Wood Pole Lines and a Study of Wind Gusts (1936)	2.00	5.00

Periodicals

Better Light—Better Sight News (9 issues yearly)	$0.75	$0.75
Edison Electric Institute Bulletin (Monthly)	2.00	2.00
Rural Electrification Exchange (Quarterly)	.60	1.00

Victory Book Campaign

THERE is being sponsored by the American Library Association, American Red Cross and the United Service Organizations, a national campaign to supply more and better books for the use of our armed forces at the many headquarters of U. S. O. in the United States.

There has been a previous drive for reading matter for the Service men. A substantial number of the books collected were in such damaged condition as to be useless.

The men that visit U. S. O. headquarters often write letters back home, but many of them like to have a good book to refresh and stimulate them.

The utility companies have been asked to help spread the message, not only to their company employees, but to the many who are contacted in the march of their business.

It is urged that books be obtained which are in sound condition and those which you liked and "really wanted to keep yourself." Books on technical subjects will be particularly appreciated.

Utility companies may join in the local campaign which opens Jan. 5 and closes on March 5. It would be doubly helpful if any scheme of collection could be made and the books turned over to the local library for disposal through organized channels.

A booklet with complete information on the Victory Book Campaign is being mailed to utility commercial departments, where public contacts are made. —C. E. G.

Oklahoma Utilities Association Announces Officers for 1943

THE Oklahoma Utilities Association has announced that J. C. Happenny, President, Oklahoma Power and Water Company, Sand Springs, Okla., will serve as president of the association during 1943.

Other officers of the association elected for the same period are: first vice-president, E. C. Joullian, president, Consolidated Gas Utilities Corp., Oklahoma City; second vice-president, George McLean, Oklahoma Gas and Electric Co., Oklahoma City; treasurer, D. S. Kennedy, treasurer, Oklahoma Gas and Electric Co., Oklahoma City; secretary, Kate A. Niblack, Oklahoma City.

New directors are as follows:

Three-year term: Glenn C. Kiley, vice-president, Oklahoma Gas and Electric Co., Oklahoma City; Frank B. Long, vice-president, Oklahoma Natural Gas Company, Tulsa.

One-year term: J. P. Arnold, Public Service Company of Oklahoma, Tulsa; C. A. Breitung, Oklahoma manager, Southwest Natural Gas Company, Ada; George A. Davis, president, Oklahoma Gas and Electric Company, Oklahoma City; and R. K. Lane, president, Public Service Company of Oklahoma, Tulsa, and Mr. Happenny.

Hold over directors: A. F. Potter, manager, The Gas Service Company, Bartlesville, Okla.; S. I. McElhoes, vice-president, Southwestern Light and Power Co., Chickasha, Okla.; W. L. Woodward, president, Zenith Gas System, Inc., Alva, Okla.; and Mr. Joullian.

Utility Commercial Departments

(*Continued from page* 10)

partments for this record—a record of constructive building because householders are obtaining value received for their appliance investments as indicated in sustained use. How far will those responsible for customer morale and the future economic life of the country carry the streamlining process of the commercial branch of the industry? Will the "geese that laid the golden eggs" be sacrificed in the attempt?

A company losing contact and goodwill of its customers loses the foundation of its business. All other industries are clinging to a nucleus of their sales and promotional forces as the reserves that will be required to win the peace. If millions of customers shall continue to be served, commercial men still have opportunity to achieve. The challenge is out, and the continuity of educational and promotional thinking—not for sales but for good-will—is not only desirable but vital to the reestablishment of the post-war market for utility service. Upon these same customers will depend the future of private utilities, an anchor to windward in the future course of private enterprise.

Electricity on the Farm

(*Continued from page* 24)

viously referred to. This simply means to continue at an accelerated rate the step-ups which have been taking place for many years past. You will recall that the productive output per worker in 1910 was considered as 100.

Electricity on the farm offers the *greatest opportunities* for securing much of the additional power necessary to increase the output per worker and meet the goals set. This will require some thought and planning. Our customers need our help. This service to farm customers should be promptly rendered.

In helping farmers take advantage of their electric service to conserve manpower and meet production goals, we will be accomplishing our utility objectives as follows:

To do everything possible to help win the war.

To keep present business.

To create a greater appreciation of our services in terms of what these services will do for customers, thus building a greater appreciation of the company rendering the services as well as the privately owned and managed industry as a whole.

CONVENTIONS AND MEETINGS

JANUARY, 1943

20-22 American Society of Civil Engineers, New York, N. Y.
25-29 American Institute of Electrical Engineers, New York, N. Y.
13-14 Missouri Valley Electrical Association, Industrial Engineering Conference, Continental Hotel, Kansas City, Mo.

FEBRUARY

8-9 Accident Prevention Committee, EEI, Hotel Gibson, Cincinnati, Ohio.
11-12 Transmission and Distribution Committee, EEI, William Penn Hotel, Pittsburgh, Pa.

T and D War Problems

(*Continued from page* 19)

of additional capacity. Both types of installation have been in service for some time with no troubles as yet having developed.

Some of you may have an old 4 ampere DC series mercury arc rectifier which has been removed from service but not yet scrapped. We recently required additional capacity on the street lighting circuits in Asheville. The possibility of using the old DC rectifiers was considered and it was found that only a few hours work were necessary to remove the rectifying equipment and reconnect the 4 ampere coils. Five of these machines are now supplying 6.6 ampere AC series street lighting circuits.

Increasing Capacity of Series Street Lighting and Open Wye 6.9/12 Kv Primary

Recently, there was an occasion to increase the capacity of an open wye 6.9/12 kv lateral through the main street of a small town. Pin space was not available for the third phase wire, and copper from our stocks could not be used. To meet this problem one conductor of an existing street lighting loop was reinsulated and converted into a primary phase conductor. The neutral which was already common with both primary and secondary circuits was used as the street lighting return. This was certainly economical use of existing materials and has given no trouble whatsoever.

Dry Cell Battery for Tripping Current

A small substation was built to serve a coal mine and it was necessary to make this station very simple but it was provided with a secondary oil circuit breaker and it was desired to provide relay tripping for this breaker. However, to provide a storage battery, station service transformer, battery charger, and other necessary accessories, would make the installation very expensive. The idea was conceived of using a conventional 9-cell 4½-volt "Hot Shot" dry cell battery for a source of tripping current. While this was put in on a trial basis, it has proven that the arrangement is very dependable with an average of 15 operations of the oil circuit breaker each year since installation and there is no record of failure in the tripping circuit. To insure dependable operation, the dry cell battery is replaced every nine to 12 months, depending upon the condition of the battery. However, it is changed once a year, regardless of its condition. The maintenance cost has been extremely low.

Recording Sub-Standard Installations

Soon after we began operating under the construction limitations imposed by Preference Rating Order P-46, it became evident that we would have to accept construction standards and practices which, when measured in the light of previous practice experience and requirement, would leave something to be desired. Sub-standard installations, unorthodox methods and installations which do not meet previous service standards are being installed with the knowledge that they are not as we would like to have them.

We intend to make a complete and formal record of all such construction which deviates from our company standards with the thought that immediately after the emergency has passed we will review all such installations and consider each one as to whether or not it should be permitted to remain in service indefinitely. Many of them we will no doubt wish to replace with standard construction, or bring up to acceptable service standards. It may be, too, that we will find some of them to have performed satisfactorily enough to be accepted as company standards from then on. We do believe, howexer, that we should not lose track of those installations for fear that they may later cause us trouble.

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